The pleasure of food in abnormal eating : a cognitive approach

The Pleasure of Food in Abnormal Eating

a cognitive approach

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proefschrift

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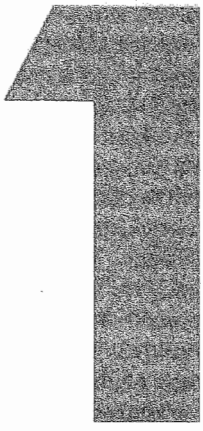
GENERAL INTRODUCTION AND THESIS OUTLINE



Imagine a nice piece of Belgian chocolate! What is your first association? It will probably be that it is tasty. Research has shown that a liking for the sensory aspects of food is the most important factor determining food choice (Eertmans, Baeyens, & Van den Bergh, 2001), which suggests that people's first association with food is likely based on the palatability of the food. Now think of an obese woman. What would her first association with that nice piece of chocolate be? Probably her first association is 'tasty' too, and it may be stronger than that of a lean person. Research suggests that food palatability is more important for obese people than for lean people (Nisbett, 1968; Pliner, Herman, & Polivy, 1990; Spiegel, Shrager, & Stellar, 1989), and that the obese have a specific preference for high-fat foods (e.g., Mela & Sacchetti, 1991; Rissanen et al., 2002). Quite the opposite might be true for an anorexia nervosa patient. What would her first association be when she imagines that piece of chocolate? As Pinel, Assanand, and Lehman (2000) suggest, palatability may be relatively unimportant for anorexia nervosa patients, for whom food may have lost its positive incentive value. The studies described in this thesis are concerned with exactly those individual differences in the evaluation of food. The central question that will be addressed in this thesis is whether an increased 'pleasure of food' at an early stage of cognitive processing is related to overeating and obesity, and whether a decreased 'pleasure of food' at an early stage of cognitive processing is related to undereating, anorexia nervosa. In the following part of this chapter, the rationale for this central question will be provided. Next, the methodology that is used in our experiments will be briefly described. The final part of this chapter gives an outline of the thesis and a brief introduction to the experiments.

OVEREATING AND UNDEREATING

In the last twenty years, the percentage of overweight and obese people has increased considerably. In the Netherlands about 9% of the population is obese, and about 33% is overweight (Visscher, Kromhout, & Seidell, 2002). So, 42% of the Dutch population is too heavy. In the United States these numbers are even more dramatic. Estimations for obesity range from 20.9% (Mokdad et al., 2003) to 30% (Flegal, Carroll, Ogden, & Johnson, 2002), whereas 35% of the population is estimated to be overweight (Hedley et al., 2004). This means that in the United States between 56 and 65% of the population is too heavy. Obesity has serious health consequences. Mokdad, Marks, Stroup, and Gerberding (2004) labeled poor diet and physical inactivity (i.e., overweight) as the number two cause of death in the United States, right behind tobacco, the number one cause. Allison, Fontaine, Manson, Stevens, and VanItallie (1999) estimated that 280.000 deaths in the United States can be attributed to obesity. Obesity is for example associated with cardiovascular diseases, type 2 diabetes, hypertension, and some forms of cancer (Must et al., 1999).

Though genes undoubtedly play a role in obesity (Barsh, Faroqi, & O'Rahilly, 2000; Comuzzie & Allison, 1998), "our genes have not changed substantially during the past two decades. The culprit is an environment which promotes behaviors that cause obesity" (Hill & Peters, 1998, p. 1371). Our obesity promoting environment is even called a 'toxic' environment by some researchers (Wadden, Brownell, & Foster, 2002). Our environment is toxic in the sense that palatable high-fat foods are available everywhere, while at the same time physical activity is discouraged in daily life (e.g., North American cities are 'made for' cars). A large body of literature suggests that the consumption of a high-fat diet plays a major

role in obesity, although evidence is not entirely conclusive (Bray & Popkin, 1998; Jéquier, 2002; Lissner & Heitmann, 1995; Schrauwen & Westerterp, 2000; Seidell, 1998; Willett, 1998). High-fat foods may play a special role in obesity because of their high energetic density and high palatability, thereby easily promoting overconsumption (Schrauwen & Westerterp, 2000). Recently, Ebbeling et al. (2004) found that overweight adolescents consumed more fast food than lean controls, and were less likely to compensate for their large fast food meal throughout the day. An - admittedly non-scientific - hint that the consumption of high-fat food leads to weight gain, is a recent "case study" conducted by the American filmmaker Morgan Spurlock. He consumed breakfast, lunch, and diner at a McDonald's restaurant for a month, and gained almost twelve kilos (*de Volkskrant*, June 12, 2004). An intriguing question is then how some people manage to stay slim in our obviously very 'tempting' environment? Could it be that obese people prefer these high-fat palatable foods to a greater extent than lean people do? Research indeed suggests that palatability is more important for the food consumption of obese people than for the food consumption of lean controls (Nisbett, 1968; Pliner et al., 1990; Spiegel et al., 1989). Pliner et al. (1990) review evidence that obese people are more responsive to the palatability of food, in that the difference between consumption of palatable versus unpalatable foods is larger for obese than for lean controls. Moreover, several studies suggest that obese people may specifically like high-fat palatable foods (e.g., Drewnowski, Kurth, Holden-Wiltse, & Saari, 1992; Gerding & Weinstein, 1992; Rissanen et al., 2002).

Though there may exist genetic influences on preferences for some foods (Falciglia & Norton, 1994; Greene, Desor, & Maller, 1975), food preferences are mostly learned. People do have the genetic predisposition to learn to prefer energy-dense foods over energy-dilute foods and to show a neophobic reaction to new foods, but our preferences are shaped by experience with foods (Birch, 1999). Increased experience with a particular food will lead to a greater liking of that food (Sullivan & Birch, 1990). So, the formation of food preferences can best be considered an interaction between genes and environment. High-fat palatable foods are available everywhere nowadays, giving plenty of opportunity for developing a preference for this type of food. Fisher and Birch (1995) found that children with heavier parents had a stronger preference for high-fat foods and consumed more of it. With reference to the study of Sullivan and Birch (1990), Fisher and Birch (1995; p. 764) suggest that "children's preferences for and consumption of dietary fat may be influenced by familial factors such as the availability of and exposure to high-fat foods." This preference in turn may promote the consumption of high-fat foods in later life. It may thus become increasingly difficult to resist high-fat foods with increasing experience with this type of food. Rissanen et al. (2002) studied monozygotic twins, and found that the obese twin recalled having eaten more high-fat foods in early adulthood than their lean co-twin. The obese twin currently liked and consumed high-fat foods to a greater extent than their lean co-twin, providing strong evidence for the learned nature of food preferences. Note that this study is based on self-report recall data which possibly compromises the reliability, and cannot determine when these preferences developed.

Another group of people who may be at risk of overeating high-fat palatable foods is formed by the so-called restrained eaters. The prevalence of obesity in our society is high, but at the same time many people try to loose weight. Neumark-Sztainer et al. (2000) found that more than half of their study population (USA) reported that they were currently on a diet. A large proportion of these dieters can be classified as restrained eaters. Heatherton, Herman, Polivy, King, and McGree (1988, p. 19) define restrained eaters, as

selected by the Restraint Scale (Herman & Polivy, 1980), as dieters who "exhibit periods of restraint punctuated by episodes of disinhibited overeating." In other words, restrained eaters are people who want to loose weight, but regularly fail and indulge in exactly those high-fat palatable foods that they normally consider "forbidden" (Herman & Polivy, 1980; Herman & Polivy, 2004). Restrained eating is hypothesized to be associated with (high-fat) palatable foods being extra desirable (Gendall & Joyce, 2001; Stice, 2002).

Whereas restrained eaters cannot be considered particularly successful dieters, patients with anorexia nervosa might be considered just that. This disorder affects on average 0.3% of the population (Hoek & van Hoeken, 2003). Based on related but different theoretical perspectives, both Pinel et al. (2000) and Jansen (1998, 2001) propose that food may have lost its incentive value for anorexia nervosa patients. Support for these ideas was found in both self-report studies and psychophyiological studies with either anorexia nervosa patients or fasting participants (e.g., Lappalainen, Sjödén, Hursti, & Vesa, 1990; Legoff, Leichner, & Spigelman, 1988). Moreover, a different line of research suggests that anorexia nervosa patients may be more anhedonic than normal controls (Davis & Woodside, 2002). In other words, they might have a deficit in experiencing pleasure. Plausibly, this suggests that they do not value the palatability of food as much as normal controls.

In sum, overeaters - obese people and restrained eaters - may like (high-fat) palatable foods to a greater extent than lean controls. On the other hand, undereaters - anorexia nervosa patients - may no longer be sensitive to the palatability of foods. That is, food may have lost its incentive value, and they may no longer consider foods in terms of palatable and unpalatable.

RESEARCH METHODOLOGY

An obvious approach to address our central question whether overeating is associated with an increased pleasure from food, and undereating with a decreased pleasure from food, would be to simply ask people what foods they like and how important the palatability of food is to them. However, it has become common knowledge for psychology researchers that self-reports can sometimes be quite unreliable. An answer on a questionnaire is influenced by the wording of the question, the context, the order, and - perhaps most importantly - socially desirable answering tendencies (Schwarz, 1999; Schwarz & Oyserman, 2001). These socially desirable answering tendencies can surely be expected to play a role in research into food evaluations. For example, because in our society the beauty ideal is to be very slim, and obese people are stigmatized (Puhl & Brownell, 2003; Teachman & Brownell, 2001), it might be increasingly difficult to admit a liking or much consumption of high-fat palatable foods with increasing body weight (Heitmann, Lissner, & Osler, 2000).

Moreover, in this thesis we were interested in relatively spontaneous responses. Because palatability was found to be the most important aspect of food for food choice (Eertmans et al., 2001), we expected that a relatively spontaneous evaluation would be based on palatability (see also Lamote, Hermans, Baeyens, & Eelen, 2004), which is exactly what we were interested in. Of course, most people will be aware of the health-related and weight concerns related aspects of food (Eertmans et al., 2001; Steptoe, Pollard, & Wardle, 1995), but these considerations may follow only after some more controlled processing after exposure to the food. To assess the relatively automatic food evaluations, we

used different kinds of so-called indirect response latency measures (Fazio & Olson, 2003). An indirect measure is indirect in the sense that the researcher does not directly ask the participant how he evaluates a certain object. As a result, participants may be unaware of what the researcher is assessing. Moreover, the process of responding may be characterized as relatively automatic, in the sense that this process is rather effortless, that participants may not be able to strategically control their responses, and that participants do not have an explicit intention to evaluate the food. In Chapter 2, a theoretical and methodological introduction is provided, in which the characteristics of these indirect response latency measures and of relatively automatic processes are described in more detail.

HYPOTHESES AND OUTLINE OF THE THESIS

For overeaters, the hypothesis was tested that they would specifically like high-fat palatable foods to a greater extent than normal controls, when assessed at a relatively early stage of cognitive processing. If an increased positive association with high-fat palatable food was detected at this early stage of information processing, it would be expected that they always experience this association, and always have to suppress it to be able to successfully inhibit their food consumption. It would also suggest that an intervention aimed at controlled processing would be a rather inefficient form of therapy, and should better be directed at these early positive associations with high-fat palatable foods. For undereaters - anorexia nervosa patients - the hypothesis was tested that they would show a reduced sensitivity to the palatability of food in comparison to lean controls at an early stage of cognitive processing. If our hypothesis for anorexia nervosa patients was confirmed, also for this group of patients an intervention aimed at controlled processing might then be considered an inefficient form of treatment. An aim in therapy could then be to restore the relatively automatic palatability-related associations with food.

In a first attempt to test the hypothesis that overeaters would show an increased liking of high-fat palatable foods at an early stage of cognitive processing (Chapter 3), we used the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), and compared a group of obese people to a group of lean controls. Importantly, in this task participants had to categorize the foods as either high-fat or low-fat, which obviously made the fat content of the food a highly salient characteristic. For a detailed explanation of this paradigm, the reader is referred to Chapter 2. After we conducted our IAT experiment, this saliency of the feature on which categorization is based (high-fat vs. low-fat in our study) was shown to have a profound influence on the evaluation or attitude that is assessed in the IAT (De Houwer, 2001, 2003a; Mitchell, Nosek, & Banaji, 2003). Plausibly, people do not like these high-fat foods because they contain a lot of fat, but like other attributes of these high-fat foods such as their taste and smell. So, categorizing foods as high-fat and low-fat might have biased the relatively automatic evaluation of food, because participants were constantly evaluating the fat content, which made fat content salient.

Based on these considerations we decided to continue our research using another paradigm. Relatively automatic associations that are activated when confronted with a palatable high-fat food such as chocolate might best be assessed in a more "bias-free" paradigm. The affective priming paradigm (Fazio, Sanbonmatsu, Powell, & Kardes, 1986) seemed well suited for this purpose. In the studies using this paradigm, participants did not need to categorize the foods in any way and a relatively automatic association was unbiased by the

paradigm. A detailed description of this paradigm can be found in Chapter 2. In Chapters 4 (Experiment 1) and 5 (Experiment 2), we used the affective priming paradigm to test our hypothesis that overeaters would have a specific liking for high-fat palatable foods in comparison to normal controls at an early stage of cognitive processing. In Chapter 5 (Experiment 1) we used the affective priming paradigm to test our hypothesis for undereaters (anorexia nervosa patients), that they would be less sensitive to the palatability of food than lean controls would be. In other words, the hypothesis was tested that the palatable - positive and the unpalatable - negative associations would be less strong for the AN group than for the lean control group at a relatively automatic level. To seek convergence in a different paradigm for a comparison of overeaters and lean controls, the Extrinsic Affective Simon Task (EAST; De Houwer, 2003b) was used as well (Chapter 4, Experiment 2). The EAST study was comparable to the affective priming studies in the sense that the EAST study did not force participants to categorize the food stimuli as high-fat or low-fat either. In the EAST study we actually tried to focus participants on the (un)palatability of food. For a detailed description of the EAST, the reader is referred to Chapter 2.

To broaden the scope of our research we also examined the effects of more controlled processing on subsequent consumption in overweight/obese people and lean controls (Chapter 6). This study aimed to investigate whether providing fat content information has a differential effect on obese people in comparison to lean controls. Because obese people often score higher on measures of restraint, that is they often try to diet (e.g., Fairburn & Cooper, 1993), the hypothesis was tested that participants would (intend to) consume less of a food labeled high-fat than of a food labeled low-fat, and that this effect would be most pronounced for obese people. So, though research suggests that obese people have a preference for high-fat foods (e.g., Rissanen et al., 2002), and are hypothesized to have more positive associations with high-fat palatable food on a relatively automatic level, they were expected to adjust their consumption to the fat content information when given the opportunity to deliberate. If this hypothesis was confirmed, this would not suggest that this would always be an easy task for obese people, but it would suggest that they are concerned about their high-fat food intake when fat content is made very salient, and adjust their intake accordingly. In other words, it would suggest that they are able to overrule the hypothesized automatic positive associations with high-fat foods when given fat content information and the time to deliberate. Note that in our current society fat content information is surely not always emphasized and obese people may not always be motivated and have the cognitive capacity to consider and adjust their food intake.

The studies described in Chapters 3, 4, and 5 assumed that relatively automatic associations with food would be stable across situations, and that the employed indirect measures would pick up individual differences in these associations. As Blair (2002) explains, this alleged stability and inflexibility across situations has contributed to the idea that these relatively automatic associations could reflect someone's "true" attitude. However, as was pointed out by Banaji (2001) and Fazio and Olson (2003), no such thing as a true attitude exists. Both relatively automatic associations as well as associations that result from more controlled processing may be valid predictors of behavior. Which type of measure (indirect vs. direct) is predictive of behavior depends on someone's motivation and opportunity to engage in more controlled processing. What is more important, a large body of research (for a review see Blair, 2002) now exists that shows that these relatively automatic associations are not stable across situations, but are influenced by for example the current focus of attention (Mitchell et al., 2003) or the context (Lowery, Hardin, &

Sinclair, 2001). So, a relatively automatic association may neither reflect a true attitude, nor be stable across situations. Lowery et al. (2001) for example showed that white participants' relatively automatic evaluations of black people were less negative in the presence of a black experimenter than in that of a white experimenter.

Whereas in the studies in Chapters 3, 4, and 5 the focus was on finding differences between diverse groups of participants under neutral or unintentionally biased circumstances (e.g., one experiment was conducted in an environment in which health was salient, a hospital), we intentionally manipulated either the focus of attention or the experienced level of craving of obese and lean participants in the experiments of Chapter 7. These manipulations were considered an interesting next step, because our living environment is obviously far from neutral. Large portions of high-fat palatable foods are available nearly everywhere (Hill & Peters, 1998; Nielsen & Popkin, 2003), providing many "temptations". In the first experiment of Chapter 7, we intentionally focused participants' attention either on the (un)palatability of food ('restaurant task') or on the health aspects of food ('health task'), just before their participation in an affective priming task that was similar to the one used in previous chapters. The hypothesis was tested that the priming effect would be based on palatability after the 'restaurant task', and would be based on health concerns after the 'health task'. In the second experiment of Chapter 7, another approach was taken to focus participants on the palatability of food, by inducing a craving for food prior to the affective priming task. The priming effect was hypothesized to be more positive (i.e., a larger preference for palatable foods over unpalatable foods) with higher levels of experienced craving. In both experiments we were interested whether the manipulations (palatability vs. health focus), the person characteristic body weight, or a possible interaction exerted a stronger influence on the palatability priming effect.

If a situational dependence of relatively automatic associations was indeed found in these experiments, it would suggest that people's early associations with food are often palatability related, because our environment provides many cues related to the palatability of food. Of course, health related cues are also present in our environment (e.g., commercials for dieting products or television spots about healthy eating), but they are probably less abundant and less attractive. Moreover, a difference between obese and normal weight people might be found in their (perception of the) environment. Possibly palatability related cues are even more abundant in obese people's direct environment. For example, obese people may start avoiding sports, an environment in which health is obviously salient. Another possibility may be that obese people's attention is drawn more toward the palatability cues than toward health cues.

In sum, the experiments of this thesis were concerned with the question of whether overeating is related to an increased pleasure of food, and whether undereating is related to a decreased pleasure of food, when assessed at a relatively early stage of cognitive processing. Moreover, the influence of the environment (palatability cues vs. health cues) on relatively automatic affective responses toward food was examined. Chapter 8 provides a general discussion of the experiments of this thesis. It is attempted to integrate the findings of the studies of this thesis, and to describe possible clinical implications. Moreover, the value of using indirect measures in this type of research and possibilities for future research will be discussed.

THEORETICAL AND METHODOLOGICAL BACKGROUND OF INDIRECT MEASURES

This chapter will be part of: Roefs, A., Wiers, R. W., de Jong, P., Huijding, J., Smulders, F. T. Y., & Jansen, A. (in preparation). *The application of indirect measures in psychopathology: A review of theories and empirical findings.*

In recent years, the use of so-called indirect response latency measures has become very popular in clinical (e.g., Teachman & Woody, 2003) and in social psychology (e.g., Rudman, Greenwald, Mellott, & Schwartz, 1999). These indirect measures are designed to assess so-called implicit attitudes. As will become clear, different theorists use the term 'implicit' in different ways. In this chapter, the characteristics of these indirect measures will be described, and they will be contrasted with direct measures. Direct measures like questionnaires are often used in research on food preferences and abnormal eating. In this type of research, people are for example simply asked to report how much they like a food or what kind of emotions they experience after eating (e.g., Gerding & Weinstein, 1992; Macht, Gerer, & Ellgring, 2003). As was discussed in the previous chapter, research that relies on self-report measures may have important drawbacks (Schwarz, 1999; Schwarz & Oyserman, 2001). Apart from the issue of social desirability, implicit attitudes may differ more fundamentally from an evaluation that results from more controlled processing (Banaji, 2001). It is still a topic of much debate how exactly these implicit attitudes are represented, activated, formed, assessed, and if and how they are related to evaluations or attitudes that are the result of more controlled processing.

Partly because terms like 'implicit', 'automatic', and 'unconscious' are sometimes used interchangeably, it becomes difficult to understand what these indirect measures actually assess. Several features that are attributed to indirect measures (i.e., implicit attitudes) are also attributed to automatic processes (De Houwer, in press). As De Houwer argues, it might be best to assess which criteria of automaticity are met by an indirect measure. McNally (1995) describes automatic processes as follows: "the consensus among experimental psychologists is that an automatic process does not require cognitive capacity, does not require awareness, and does not involve volition" (p. 747). In a little more detail, apart from unawareness, the concept of automaticity is also used to refer to the features uncontrollability, unintentionality, goal-independency, and efficiency. The exact meanings of these terms will be specified later in this chapter.

In this chapter, three theoretical positions regarding the concepts of implicit attitudes will be discussed. In discussing these models we will adhere to the terminology that is used by the developers of these models. These three models have been developed in social psychology, and are therefore concerned with attitudes. The research in this thesis is concerned with evaluations of food, but the difference may merely be a matter of terminology. Fazio, Chen, McDonel, and Sherman (1982) view attitudes as "an association between a given object and a given evaluative category" (p.341, see also Banaji, 2001).

The models that will be discussed in this chapter are all so-called dual-process models (Smith & DeCoster, 2000). Dual-process models propose two modes of processing, one of which can be considered relatively automatic, whereas the other mode can be considered more controlled. The three models that are chosen represent related but different theoretical perspectives, and may be used to structure the mostly "empirically driven enterprise" of indirect measures (Fazio & Olson, 2003, p. 301). These theoretical positions include the dual-attitude model (Wilson, Lindsey, & Schooler, 2000), the MODE model (Fazio & Towles-Schwen, 1999), and the Two Systems Model (Strack & Deutsch, 2004). For each model, five questions will be considered: 1) Are people unaware of the implicit attitude itself? 2) Apart from unawareness, how automatic are implicit attitudes? 3) Are implicit and explicit attitudes related? 4) Are implicit attitudes stable constructs? and 5) How are implicit attitudes formed? For a schematic overview of the models, see Table 2.1. Following the description of these models, the three paradigms that are used in this thesis will be discussed. Then,

empirical evidence is reviewed regarding the characteristics of the processes that are assessed by the indirect measures, and that are proposed by the models. This review of empirical evidence will be organized along the same five questions.

Table 2.1 Overview of models of implicit and explicit attitudes

model	unaware of implicit attitude?	other aspects of automaticity	implicit and explicit related?	implicit attitude stable construct	how are implicit attitudes formed?
Dual Attitude Model	Unresolved issue. Depends on type of dual attitude.	No cognitive capacity or motivation is needed. Relates to efficiency, goal independency, and unintentionality.	Model can explain absence of correlation, but does not necessarily state that they are uncorrelated.	Yes, relatively stable, and hard to change. Explicit attitude cannot replace implicit attitude.	Culture and personal experience with the attitude object.
MODE Model	People may be unaware of measurement, but not necessarily of attitude itself.	No conscious effort (i.e., efficient), unintentional, and uncontrollable.	Depends on motivation and opportunity.	Automaticity seems to imply stability, but the authors acknowledge evidence to the contrary.	Meaningful personal variability exists. What is automatically activated is not necessarily a cultural stereotype.
Two Systems Model	Considers consciousness an epiphenomenon.	Fast acting processes that require little cognitive effort (i.e., efficient).	Impulsive and Reflective system operate in parallel, and interact at various stages of processing	Impulsive system is inflexible. Links in the associative network can only change slowly.	Features that co-occur often (in reality or in Reflective System) form associative clusters.

THEORIES OF IMPLICIT ATTITUDES

Dual-Attitude Model

The dual-attitude model (Wilson et al., 2000) states that an implicit and an explicit attitude coexist in memory. The term dual attitude refers to different evaluations of a single attitude object. If people do not have enough capacity or motivation to retrieve the explicit attitude, then the implicit attitude guides responding and behavior. If people have enough capacity and motivation to retrieve the explicit attitude, this attitude guides only explicit responses. The implicit attitude still guides the implicit responses. When the explicit attitude is retrieved from memory, it overrides the implicit attitude, but does not replace it. Wilson et al. (2000) propose four types of dual attitudes: 'motivated overriding', 'repression', 'independent systems', and 'automatic overriding'. These terms will be explained in more detail shortly.

1. Are people unaware of the implicit attitude itself?

Following Greenwald and Banaji (1995), Wilson et al. (2000) define an implicit attitude as having an unknown origin, as activated automatically, and as influencing implicit responses. Note that Wilson et al. (2000) acknowledge that it is "an unresolved issue whether people are aware of the implicit evaluation itself" (p. 104). The process of implicit attitude activation is automatic (see question 2), but people can be aware of the resulting implicit attitude itself, depending on the kind of implicit attitude. For a first type of dual attitudes - 'motivated overriding' - this seems especially true. In this case of dual attitudes, people are aware of their implicit attitude but they do not approve of that automatically activated attitude, and are very motivated to override it with a more favorable explicit attitude. A good example is research on racial prejudice, in which it is found that most white people have a negative implicit attitude toward Black people, whereas their explicit attitude is more egalitarian (Fazio, Jackson, Dunton, & Williams, 1995; Greenwald, McGhee, & Schwartz, 1998).

Wilson et al. (2000) discuss a second and third type of dual attitudes that do involve an unconscious implicit attitude: 'repression' and 'independent systems'. Repression means that the implicit attitude is "kept out of awareness because it is anxiety-provoking" (p. 105). In the case of independent systems, "people have both implicit, nonconscious systems and explicit, conscious systems that independently develop evaluations. The implicit attitude is automatic and never reaches awareness" (p. 106). Wilson et al. (2000) acknowledge that both these types of dual attitudes are very controversial, because they imply that people never become aware of their implicit attitude. A fourth and final type of dual attitudes that these authors discuss is 'automatic overriding'. With this type of dual attitudes people will not be aware of their implicit attitude when they have enough cognitive capacity to retrieve their explicit attitude. This explicit attitude will automatically override the implicit attitude. If people do not have enough cognitive capacity, people will become aware of their implicit attitude. The authors admit that this last variant of dual attitude is also still speculative.

2. Apart from unawareness, how automatic are implicit attitudes?

The dual-attitude model states that implicit attitudes are activated automatically and qualifies this as meaning that the activation does not demand cognitive capacity or motivation.

These aspects of automaticity are shared by all types of dual attitudes of their model. The qualification 'no need for cognitive capacity' relates to the feature of 'efficiency', whereas 'no need for motivation' relates to the features of 'goal independency' and 'unintentionality'.

3. Are implicit and explicit attitudes related?

The dual-attitude model specifically postulates that an implicit and an explicit attitude can co-exist in memory. So, this model can easily explain an absence of a correlation between implicit and explicit attitudes across members of a population. One type of dual attitudes - independent systems - postulates that the implicit and explicit attitudes are formed independently. The model does not imply that implicit and explicit attitudes are necessarily uncorrelated.

4. Are implicit attitudes stable constructs?

The dual-attitude model assumes that implicit attitudes are relatively stable and hard to change, whereas explicit attitudes can be changed more easily. Moreover, though people retrieve an explicit attitude when they have enough cognitive capacity and motivation, this explicit attitude does not replace the implicit attitude, but only overrides it temporarily, until "the new attitude 'wears off' and the original implicit attitude re-emerges" (p. 110).

5. How are implicit attitudes formed?

Implicit attitudes are thought to develop from both culture and personal experience with the attitude object. They are considered comparable to 'old habits', which have slowly developed during people's lives.

MODE Model[1]

The MODE model was developed during the 80's, long before the rush of research into the automatic activation of attitudes that followed the invention of the IAT (Fazio, 1990; Fazio & Towles-Schwen, 1999). MODE is an acronym for "Motivation and Opportunity as DEterminants" (Fazio & Towles-Schwen, 1999, p. 100) of attitude accessibility. An attitude can be activated automatically and can guide perceptions of the attitude object also automatically. This automatic process can be viewed as 'theory-driven'. The likelihood of automatic activation depends on the associative strength between an object and an evaluation (Fazio, Sanbonmatsu, Powell, & Kardes, 1986, but see Bargh, Chaiken, Govender, & Pratto, 1992). These automatically activated attitudes already exist in memory, and merely need activation. In contrast, when people engage in a more deliberative process, they rely upon the raw data. People then use and analyze the relevant information in the situation, and base their attitude on that information. In other words, the attitude is constructed on the spot, is a result from a deliberative process, and is not just retrieved from memory. In contrast, the dual-attitude model (Wilson et al., 2000) considers this explicit attitude to be represented in memory as well.

In the MODE model, whether people function in a relatively spontaneous way or engage

[1]For consistency reasons we used the same subheadings - including the terms 'implicit attitude' and 'explicit attitude' - in the discussion of the MODE model. In this section the terms refer to the measurement of the attitude, not the attitude itself.

in more deliberative processing depends on both motivation and opportunity. In other words, people need to be willing to deliberate and need to have the cognitive resources and time available.

1. Are people unaware of the implicit attitude itself?

Note that Fazio does not use the terms 'implicit' and 'explicit' to refer to automatically activated attitudes and attitudes that result from more deliberative processing, respectively. In a recent review, Fazio and Olson (2003) explain why they refrain from using these terms that way. A first reason why they do not like to use the term 'implicit attitude', is that it carries the notion of 'unaware'. As they argue, it can absolutely not be guaranteed that an individual is unaware of his automatically activated attitude. Fazio and Olson argue that it seems unlikely that people are unaware in the case of racial attitudes, but do not exclude the possibility in other areas. A second reason is that the implicit-explicit distinction suggests that the explicit attitude is independently stored in memory, whereas this explicit attitude might be constructed on the spot. Fazio and Olson prefer to use the terms implicit and explicit to refer to the method of measurement[2].

An implicit measurement technique (e.g., affective priming paradigm) is implicit because it measures people's attitudes without directly asking them for their attitude. By using these implicit measures, people may be unaware that the researcher measures their attitude, but that surely does not mean that they are not aware of their attitude. Note that the dual-attitude model (Wilson et al., 2000) does not necessarily contend that implicit attitudes exist outside awareness. They too consider that a matter of debate, and only consider the origin and activation of the attitude to be implicit.

2. Apart from unawareness, how automatic are implicit attitudes?

As was just discussed, the MODE model does not characterize implicit attitudes as unaware. They propose two modes of processing: a spontaneous, automatic mode of processing, and a deliberative, controlled mode of processing. The term automatic is used to refer to the absence of conscious effort (i.e., efficiency), intent, or control (Fazio & Towles-Schwen, 1999).

3. Are implicit and explicit attitudes related?

Fazio and Olson (2003) argue that it might be more appropriate to ask yourself *when* implicit and explicit measures are related. When either motivation or opportunity is low, the correlation between implicit and explicit measures will be high. When both motivation and opportunity are high, it is less likely to find a correlation between implicit and explicit measures. If an issue is more socially sensitive, motivation on the part of the participant is more likely to be high. A lack of correlation between implicit and explicit measures could be explained by unwillingness of the participant to report the attitude that is revealed by the implicit measure on an explicit measure, because it is socially undesirable. Notably, the authors argue that both attitudes can be valid predictors of behavior, depending again on motivation and opportunity. Thus, there is no such thing as a 'real attitude'.

[2] Fazio and Olson (2003) actually prefer the terms indirect and direct measures, instead of implicit and explicit measures. In this chapter we mostly followed the suggestion of using the terms 'direct' and 'indirect'. However, as they admitted as well, the terms 'implicit' and 'explicit' are used widely now (see footnote 1).

The authors also discuss the possibility of mixed processes - processes that are neither strictly spontaneous, nor strictly deliberative. An attitude may be activated automatically upon perceiving an attitude object, but may also function as a cue for more deliberative processing for example. So, the resulting attitude-behavior process is mixed, and contains both spontaneous and deliberate elements.

4. Are implicit attitudes stable constructs?

Fazio and Olson (2003) point to the literature on automatism in which consistent and repeated mapping is considered important for the development of automatism. From that, Fazio and Olson conclude that "it is thought that such attitudes develop slowly and that any change will be difficult and will require extensive practice" (p.319). On the other hand, they also briefly discuss some evidence suggesting that these kinds of attitudes are malleable, in that some experimental manipulations have been successful in changing these automatically activated attitudes relatively quickly. This issue will be discussed more fully in the section on empirical support.

5. How are implicit attitudes formed?

"The MODE model suggests that there will be meaningful variability in the nature of the evaluations that are activated from memory automatically. What is automatically activated from memory is not necessarily some socially shared cultural stereotype, but personal evaluations - attitudes." (Fazio & Towles-Schwen, 1999, p. 104). So, these automatic associations are formed by someone's personal experience.

Two Systems Model

Strack and Deutsch (2004) explain social behavior as caused by both reflective and impulsive processes. Implicit processes are located in the Impulsive System, whereas explicit processes are located in the Reflective System. This dichotomy is comparable to other dual process models (Smith & DeCoster, 2000). Knowledge in the Impulsive System is represented as patterns of activation in an associative store (can be seen as long term memory), whereas information in the Reflective System is represented as elements connected by semantic relations to which a truth value is attached (temporary storage). The Impulsive System requires no or little cognitive capacity, and always processes the perceived information, whereas the Reflective System will only process the information when there is enough cognitive capacity. Behavioral schemata can be activated by both the Impulsive System and the Reflective System. The Impulsive System activates a behavioral schema through spreading activation from perception or imagination, whereas the Reflective System activates a behavioral schema through a decision based on knowledge about facts and value. Finally, when an organism is deprived of a basic need, this will lead to activation of behavioral schemata that fulfilled that need in the past. The experience of the basic need is linked with the successful fulfillment of that need in the past in the Impulsive System.

1. Are people unaware of the implicit attitude itself?

Strack and Deutsch (2004) explicitly state that the Impulsive and Reflective System cannot be distinghuished based on the presence or absence of consciousness, with reference to consciousness theorists like Libet and Wegner (Libet, Gleason, Wright, & Pearl, 1983; Wegner, 2002). The authors refrain from using the term implicit attitude. The term attitude

is reserved for what others call the explicit attitude and is defined "as a belief following from an evaluative decision that follows from reflection about what is good or bad" (p. 239). Instead of implicit attitudes, Strack and Deutsch speak of evaluative associations "to describe links between concepts and evaluative responses in the Impulsive System" (p. 239). Indirect measures are thought to tap these evaluative associations. Though they do not use consciousness as a basis of the division into two systems, they do argue that activation in the Impulsive System can result in a state of core affect like pleasure - an experiential state of awareness, whereas operations in the Reflective System are accompanied by a noetic awareness - knowing that something is the case or not.

2. Apart from unawareness, how automatic are implicit attitudes?
The impulsive system is considered to operate automatically in that processing is assumed to be fast and to require little cognitive effort (i.e., efficient).

3. Are implicit and explicit attitudes related?
The Impulsive and Reflective System operate in parallel and interact at various stages of processing. First, representations in the Reflective System are based on the retrieval from elements of the Impulsive System. In the Reflective system this input is organized in a semantic schema and a truth value is attached. Second, at the level of decisions, core affect, as generated in the Impulsive System may enter the Reflective system and be used as basis of judgment. Third, at the level of behavioral control, the two systems may either operate in synergy, or they may compete. Competition will result when someone sees a dessert for example, and the Impulsive System activates an approach tendency (eat dessert), while the Reflective System activates the behavioral schema of going for a walk, based on the decision to diet.

4. Are implicit attitudes stable constructs?
The Impulsive System is rather inflexible. The links in the associative network can only change slowly, and follow the law of effect, the law of readiness, and the law of practice (Thorndike 1911, in Strack & Deutsch, 2004). The only way in which the Impulsive System can be more flexible is through its external or internal condition. The Impulsive System can be tuned to have a motivational orientation of either approach or avoidance (external). Moreover deprivation of basic needs (internal condition) will lead to appropriate activation of behavioral schemata to satisfy the need.

5. How are implicit attitudes formed?
The associative links in the Impulsive System are formed based on contiguity and similarity. Features that co-occur often form associative clusters. This co-occurrence need not be in reality, but can also be in the Reflective System. Elements that frequently co-occur in the Reflective System will also be associatively linked in the Impulsive System. Every representation in the Reflective System activates the corresponding elements in the Impulsive System.

INDIRECT MEASURES

Different paradigms have been developed to measure implicit attitudes or evaluations.

These paradigms may be more or less effective in assessing these implicit attitudes or evaluations. This will be further discussed in the section on empirical evidence. In the following section of this chapter, the basics of the three paradigms that are used in this thesis will be described. The research in this thesis started with the Implicit Association Test (IAT; Greenwald et al., 1998; Chapter 3). As will be explained in the following, the IAT has some disadvantages. To avoid these disadvantages, we continued our research using the affective priming paradigm (Fazio et al., 1986) in Chapters 4, 5, and 7, and the Extrinsic Affective Simon Task (EAST; De Houwer, 2003b) in Chapter 4.

The Implicit Association Test (IAT)

Greenwald et al. (1998) developed the IAT as an indirect measure of attitudes. The description of the IAT will be tailored to the experiment reported in Chapter 3. For a schematic overview of the IAT paradigm, the reader is referred to Figure 2.1. In the IAT, stimuli are presented one at a time on a computer monitor. Participants' task is to categorize each stimulus as quickly as possible according to a concept (high-fat vs. low-fat foods) or an attribute (positive vs. negative) dimension, while avoiding too many mistakes. The IAT consists of five steps, of which four are subsequently repeated to achieve within-subjects reverse order counterbalancing. The first two steps consist of practice trials for the participants to learn the categorizations separately for the concept-dimension (high-fat vs. low-fat) and the attribute-dimension (positive vs. negative). In the third step, the initial combination block, high-fat and low-fat food words and positive and negative stimuli are presented randomly, while alternating stimuli from the concept-categories and stimuli from the attribute-categories (e.g., left = high-fat/positive; right = low-fat/negative). In the fourth step, the key assignment for the concept dimension is reversed (e.g., left = low-fat, right = high-fat). The fifth step is the reversed combination block, and works the same as the third step, but now the key-assignment for the concept dimension is reversed (e.g., left = low-fat/positive, right = high-fat/negative). The IAT effect is calculated as the difference in average response latency between steps 3 and 5. The logic behind the IAT is that it is easier to respond to two categories of stimuli when these categories are associated than when they are not associated (high-fat and negative in step 5 vs. high-fat and positive in step 3). Note that recently the proper way of analyzing IAT data has been discussed (Greenwald, Nosek, & Banaji, 2003; Smulders, Wiers, & Roefs, 2004)

Figure 2.1 Overview of the IAT as it is used in the study described in Chapter 3. In the row 'task instructions', the star indicates which key-press is required (right vs. left).

Step	1	2	3	4	5
task description	initial target concept discrimination	attribute discrimination	initial combination task	reversed target concept discrimination	reversed combination task
task instructions	* high-fat low-fat *	* positive negative *	* high-fat * positive low-fat * negative *	high-fat * * low-fat	high-fat * * positive * low-fat negative *

Extrinsic Affective Simon Task (EAST)

De Houwer (2003b) developed the EAST to overcome some of the disadvantages of the IAT. A virtue of the EAST is that the computation of the EAST effect does not depend on a comparison of two separate trial blocks as is the case in the IAT (combination vs. reversed combination), but can be assessed in one block. An additional advantage of this paradigm is that the EAST can estimate an attitude toward one target concept, instead of a relative comparison between two concepts as is the case in the IAT. Finally, in the EAST, participants do not have to categorize the concept stimuli (colored stimuli) into pre-defined meaningful categories (c.f. IAT: high-fat vs. low-fat). The forced categorization into high-fat and low-fat could be a problem because it biases the way participants conceptualize the foods (see De Houwer, 2001, 2003a).

In the EAST, white, blue, and green stimuli are presented one by one in the centre of a computer monitor. In our application of the EAST, the white stimuli are synonyms of the concept 'palatable' and 'unpalatable'. Participants are asked to classify these words based on their meaning, and press one key for synonyms of 'palatable' and one key for synonyms of 'unpalatable' (e.g., left = palatable, right = unpalatable). The colored stimuli are food stimuli that can be differentiated both on the basis of fat content and on the basis of palatability. Participants are asked to categorize these food stimuli on the basis of their color (e.g., left = blue, right = green). So, fat-content and palatability of these food stimuli are irrelevant for the participants' task. After some practice blocks, white and colored stimuli are presented mixed and presented randomly in a proportion of one (white) to two (colored).

In this example, it should be easier to respond to palatable foods when they are presented in blue than when they are presented in green, because both synonyms of palatable (white) and blue food stimuli require the same response (left key press). Similarly, it should be easier to respond to unpalatable foods when they are presented in green then when they are presented in blue, because both synonyms of unpalatable (white) and green food stimuli require the same response (right key press).

Affective Priming Paradigm

In the *affective priming* paradigm (Fazio et al., 1986; Klauer & Musch, 2003), two stimuli are presented in quick succession, a prime (often the attitude object) followed by a target. No response is required to the prime, which is simply displayed and replaced by the target. Participants have to respond to the target by evaluating it as being positive or negative. The dependent variable is the positive/negative key-press latency in response to the target.

The focus of the priming paradigm is on the extent to which the presentation of the prime influences the response to the target. Typically, affectively congruent prime-target pairs (e.g., 'love' - 'happy') lead to shorter response latencies to the target word than do affectively incongruent prime-target pairs (e.g., 'love' - 'awful') (e.g., Bargh et al., 1992; Fazio et al., 1986; Hermans, De Houwer, & Eelen, 1994, 2001). The critical idea is that the pattern of response latencies as a function of affect match between prime and target indicates how people evaluate the prime on a fairly automatic level. Applied to the palatability of food, if people respond faster on congruent trials ('palatable - positive' and 'unpalatable - negative') than on incongruent trials ('palatable - negative' and 'unpalatable - positive'), it can be inferred that they like palatable foods more than unpalatable foods.

EMPIRICAL SUPPORT

The extant literature on indirect measures delivers empirical evidence that may or may not support the nature of the processes presumed by various models. On the one hand, these paradigms may be more or less successful in measuring these concepts, and on the other hand the models may not be entirely correct. The problem remains that the measures that are used may not be entirely valid for assessing the processes proposed by the models. To give a simple example, if a Martian wanted to test the theory that people on earth are taller than Martians, he might weigh people on the assumption that heavier people are taller. He might then falsely conclude that people are taller than Martians, when in fact people are more obese. So when empirical evidence is not (consistently) found, one can either doubt whether the paradigm successfully assesses the processes proposed by the model or whether the model is correct. This review is organized along the same five questions as the description of each model itself. Mainly evidence of research using one of the paradigms (i.e., IAT, EAST, affective priming paradigm) of this thesis will be reviewed.

1. Are people unaware of the implicit attitude itself?

Though the term 'implicit attitude' may seem to imply that the attitude itself is unconscious, this is not how the term is meant in the models that were reviewed before, and what researchers in the field generally mean by this term. According to the dual-attitude model (Wilson et al, 2000), this is an unresolved issue, but unawareness of the implicit attitude is considered as highly unlikely. Fazio and Olson (2003; MODE model) argue that people may be unaware of the measurement of the attitude, but that participants are likely aware of the attitude itself. The two systems model (Strack and Deutsch, 2004) considers consciousness as an epiphenomenon, and the division into a reflective and impulsive system is not based on the presence or absence of consciousness. To our knowledge, unawareness of the implicit attitude itself has not been tested empirically, and actually seems a rather difficult job. In the following we will discuss evidence regarding whether people are unaware of the measurement of their attitude and the origin of their attitude.

Monteith, Voils, and Ashburn-Nardo (2001) studied racial bias using an IAT and interviewed participants afterward about how they experienced the IAT and what they thought was the goal of the study. In this study, 64% of the participants 'felt' the IAT effect in that they realized that they were slower in the incompatible block than in the compatible block. Of this 64%, 37% attributed this slowness to racial associations. Moreover the degree of IAT bias and the recognition of this bias were significantly and positively correlated. Monteith et al. (2001) argue that this should not be taken as evidence that the IAT actually does not achieve its goal of assessing implicit racial biases. They argue that "the IAT is an implicit measure because it is driven by automatic processes and people are unaware of the causal underpinnings of their performance at the time of their performance, even if they can accurately guess that their performance was influenced by racial associations" (p. 408, footnote 3).

De Houwer (in press) argues that not being aware of what your performance originates from seems a weak form of unawareness. This type of unawareness is exactly what Olson and Fazio (2001) showed. In an evaluative conditioning procedure, participants were exposed to frequent pairings of novel objects (Pokemon figures) with either positive or negative attributes. On both an explicit measure and on the IAT, participants showed evidence of an acquired preference for the Pokemon figure that had been paired with positive

attributes. Interestingly, an awareness test suggested that participants were not aware of the pairings. Note that they were aware of the resulting attitude as is indicated by the effect on the explicit measure.

Returning to the issue of unawareness of the measurement, the degree to which participants realize what the IAT is assessing may also depend on the topic of the IAT, in that some IATs may be less 'obvious' than others. With respect to the EAST and supraliminal affective priming, no relevant studies could be found regarding the awareness participants may have had about the measurement itself. It may be interesting to note that affective priming effects can be found when the prime is presented suboptimally. The goal of suboptimal presentation is that the participant is not aware of the prime. It likely has the effect that participants are unaware of the measurement of their attitude (Klauer, Mierke, & Musch, 2003). Notably, in a stereotype (i.e., not affective) priming study (Blair & Banaji, 1996, Experiment 1), 70% of the participants reported awareness of the possibility that the presentation of the prime word could influence their responding to the target word. The degree of priming did not seem to vary between aware and unaware participants.

The concept 'implicit' carries the notion of 'unconscious', but it connotes more than just that. As De Houwer (in press) points out, it is likely an oversimplification to just state that a process is 'implicit' or 'automatic'. He argues that it may be a more viable approach to check which features that are attributed to an automatic process characterize the processes that are active when people take part in an indirect task. So, instead of using the term 'implicit' for these process, De Houwer proposes to use the term 'automatic' and - perhaps more importantly - to check in what sense a cognitive process is automatic. De Houwer (in press) reviews some of the evidence regarding different features of automaticity for different paradigms. In the following part of this chapter we will also provide that evidence, but we will focus specifically on the three paradigms that are used in the research of this thesis. The feature 'unawareness' has just been discussed extensively. Empirical evidence regarding the other features of automaticity - uncontrollability, goal independency, unintentionality, and efficiency - will be discussed in the next part of this chapter.

2. Apart from unawareness, how automatic are implicit attitudes?

A. Uncontrollability. For the IAT, several studies have directly tested the degree to which the IAT can be faked (controlled). The pattern of results is not entirely unequivocal, but this may be explained by the differences in instructions, the amount of information that was given to achieve the faking, and whether participants first did a practice IAT. The faking instructions given by Egloff and Schmukle (2002) were probably the subtlest. They simply asked participants to try to appear as good as possible for a job interview, and they did not give participants the opportunity to practice the IAT. In this study, participants were not able to fake the IAT to a statistically significant degree. Similarly, but giving a little more information, Banse, Seise, and Zerbes (2001), and Asendorpf, Banse, and Mücke (2002) did not find evidence for the possibility to fake an IAT either. Kim (2003) did not find evidence for faking the IAT in his first experiment, but when he gave participants the strategy of slowing down on the compatible trials, the IAT-effect disappeared. This intentional slowing down might be detected by the researcher on careful examination of the IAT data (Kim, 2003), and thus may not be considered successful faking. Steffens (2004) specifically notes that faking becomes easier after having some experience with the IAT. In two experiments, participants were first given a practice IAT, and were given specific instructions (e.g., to appear conscientious). Only in her second experiment participants were able to fake the

IAT to a statistically significant degree. This experiment also tested whether knowing that response latencies are the critical factor in the IAT would influence the capability of faking. This proved not to be the case, but that may be explained by the fact that all participants received a practice IAT, which may have made it apparent for participants that response latencies were important. Notably, the faked IAT still correlated with the baseline IAT. Steffens (2004) concludes that the IAT can be faked, but only to a limited degree. Fiedler and Bluemke (2003) provided participants with most information regarding the mechanism of the IAT, and they consider the faking instructions in other studies too weak. Their participants first received information about the purpose of the IAT, followed by a practice IAT. Then, participants were provided with feedback about their IAT performance in which response latencies in the two critical blocks were explicitly mentioned. Then, participants received graded faking instructions with more or less specific strategies (between subjects manipulation), and results suggest that faking was successful in all conditions. In sum, the studies reviewed above suggest that naïve participants without prior IAT experience are likely unable to fake their IAT performance. Participants can successfully fake an IAT when they have IAT experience and receive explicit faking instructions, or when they have IAT experience and are given an extensive explanation of the IAT. Note that these latter two situations represent unrealistic experimental settings in which the indirect character of an IAT is damaged rather severely.

To our knowledge, no studies have been reported that specifically investigated whether the affective priming effect or the EAST effect can be faked (controlled). Though it is an empirical question, responses can be expected to be rather uncontrollable, as long as speeded responses (by instructions and a short SOA) are emphasized, and participants do not know how the affective priming paradigm or the EAST work. The speeded character of these indirect measures is very important, and by taking out exactly that element (as was done in some IAT faking instructions), more time is left for controlled processing, and therefore may results in the controllability of the effect. The goal of the experiment should be as unobtrusive as possible and the possibility of controlled processing should be maximally reduced. Related to the issue of speed is the stimulus onset asynchrony (SOA; i.e., time that elapses between the onset of the prime and the onset of the target) in the affective priming paradigm. Several studies (Hermans et al., 2001; Hermans, Spruyt, & Eelen, 2003) have shown that affective priming effects can only be found reliably when the SOA is short (150 ms is optimal), whereas it dissipates at longer SOAs. This is indirect, but rather strong evidence that the affective priming effect relies on fast acting processes, and can only be found when there is little time for controlled processing.

B. Goal-independency. The feature of goal-independency refers to whether people should have an 'evaluative mindset', that is the goal to evaluate the stimuli that they encounter, for an effect on an indirect measure to occur. For a process to be characterized as automatic people should not need to have the goal of evaluation. The affective priming studies in the current thesis all use the evaluation task. This means that the task for participants is to evaluate the target words. As a result, it can be argued that participants are in an evaluative mindset (goal is evaluation). More specifically, there is an overlap between a relevant dimension of the stimuli (affect: positive vs. negative) and the evaluation dimension of the task. The pronunciation task - just pronouncing the target stimulus - is an alternative to the evaluation task, and has the advantage of not putting participants in an evaluative mindset, thereby meeting the criterion of goal-independency. The drawback of the naming task is that findings are mixed (Klauer & Musch, 2003). Some studies found sig-

nificant priming effects when using the naming task (e.g., Bargh, Chaiken, Raymond, & Hymes, 1996; Hermans et al., 1994, 2001), whereas other studies did not (e.g., Klauer and Musch, 2001; Spruyt, Hermans, Pandelaere, De Houwer, & Eelen, 2004). Results for the evaluation task are more consistent than for the naming task and this indirectly suggests that the goal of evaluation is important for priming effects to occur (Klauer & Musch, 2003). Moreover, Vorberg (2003) showed that even masked priming depends on task relevance. Only (in)congruency of prime and target of the task-relevant aspects produced priming.

Notably, recent research makes the issue of whether the pronunciation task reliably produces priming effects more complicated and can possibly explain why some studies did find priming effects with the pronunciation task, whereas other studies did not. Spruyt, Hermans, De Houwer, and Eelen (2002, 2004) found that the naming task works for picture-stimuli. De Houwer, Hermans, and Spruyt (2001) found affective priming effects with the naming task when using degraded stimuli. De Houwer and Randell (2004) used a conditional naming task, and found evidence for affective priming when participant's decision whether to name the target depended on semantic processing, but not when it depended on color. As Spruyt and colleagues and De Houwer and colleagues argue, these types of stimuli (pictures and degraded stimuli) and instructions are more likely to activate the semantic system in the naming task, whereas word stimuli might only activate their phonemic representation. So, goal independent affective priming effects can be found when certain conditions are met.

For the other two paradigms, the IAT and the EAST, goal independence is not an issue that can be investigated. The task (goal) of evaluation is an essential part of both an attitude IAT and an attitude EAST, because one sort of stimuli (attribute dimension or the white stimuli) always has to be categorized along an evaluative dimension. So, participants are necessarily in an 'evaluative mindset'.

C. Unintentionality. A feature related to goal independency is unintentionality, and refers to whether people need to intentionally process (the valence of) the so-called attitude-object. Some studies (e.g., Hermans et al., 1994) found evidence for affective priming when participants were instructed to ignore the prime. So, the affective priming effect was significant, even when participants did not intentionally process the prime. Another frequently used argument for unintentionality is that affective priming effects are typically found at a short SOA, (Hermans et al., 2001), leaving little time for intentional processing (Neely, 1977). As De Houwer (in press, footnote 2) notes, this argument is not entirely valid, and priming effects at a short SOA should only be taken as evidence that the priming effect itself is not due to an intentional strategy (Neely, 1977). Participants may intentionally process the valence of the primes, but not intentionally use this information for the evaluation of the targets.

In the affective priming studies in this thesis we do not instruct participants to ignore the prime, but instead, following Zack, Toneatto, and MacLeod (1999), we introduce a free recall task for the primes after the practice-block of the priming task, thereby suggesting that such a free recall task will also follow also the experimental blocks. The advantage of this free recall task is that it provides participants with a reason for the presence of the primes, and may thereby make the purpose of the research more unobtrusive (Fazio, 2001). So, processing of the primes is partly intentional, but note that intentional evaluation is not a task requirement. In the IAT and EAST, participants have to categorize the stimuli that they intentionally process. So, the processes of the IAT and EAST are partly intentional as well, but participants do not need to evaluate the exemplars of the concept categories

(e.g., high-fat and low-fat foods; c.f. primes) intentionally. In the IAT, participants categorize the concept stimuli along a non-evaluative dimension, and in the EAST categorization is based on the color of the presented concept stimuli.

D. Efficiency. The feature efficiency refers to the degree to which a cognitive process requires resources. Hermans, Crombez, and Eelen (2000) used a concurrent memory task to test whether the affective priming effect could be shown under cognitive demanding conditions. Hermans et al. argue that in real life, people are often under high cognitive load, and that it would be interesting to know whether people can still evaluate objects in their surroundings then. Their results confirmed their expectations, and they found an affective priming effect independent of the cognitive load condition. This suggests that affective priming is an efficient process, because no attentional resources are required. Hermans et al. note that their procedure cannot guarantee that participants' resources were fully exhausted. So, for now they suggest to speak of relative efficiency. To our knowledge, no experiments have directly manipulated mental load for either the IAT or the EAST.

Summary and conclusions.[3] As De Houwer (in press) and Fazio and Olson (2003) contend, a measurement can objectively be considered indirect, simply because participants are not directly asked to report their attitudes. The processes assessed by indirect measures are relatively automatic. Depending on exactly which paradigm is used, these processes meet some criteria of automaticity, whereas they fail to meet other criteria of automaticity. Exactly which criteria are met is always an empirical question. Tentative conclusions will be drawn regarding which criteria for automaticity are met by each of the paradigms that are used in this thesis. Note that not all criteria have been investigated for all paradigms yet.

For the IAT, it can be concluded for now that the assessed processes are rather uncontrollable, at least when participants are inexperienced and are naïve as to the purpose and mechanism of the IAT. Concerning the feature of unawareness, it seems unlikely that participants are unaware of the assessed attitude itself, whereas evidence suggests that participants may be unaware of what their attitude originated from (Olson & Fazio, 2001). Notably, Monteith et al. (2001) found that a substantial number of participants were aware that their attitudes were being measured. The IAT effect was larger for the aware participants, but the IAT effect did not depend on such awareness. For the features of unintentionality, goal independence, and efficiency, no relevant studies could be found, likely because the IAT is a relatively new measure. Note that the criteria of unintentionality or goal independence seem impossible to meet given the nature of the IAT procedure. The EAST is an even newer measure (De Houwer, 2003b), and no specific experiments concerning the features of automaticity could be found. It could be argued that the EAST is less 'obvious' for participants, and may be unobtrusive (i.e., unaware of measurement) and uncontrollable to at least the same degree as the IAT.

For supraliminal affective priming, different aspects of automaticity have been systematically studied. The findings that priming effects only exist at short SOAs and disappear at longer SOAs is indirect, but rather strong evidence that priming effects are due to fast-acting processes (Hermans et al., 2001, 2003). In other words, priming effects can only be found when participants are hardly given any time for controlled processing. Moreover, a

[3] The terminology that we used in Chapter 3 is at odds with this characterization of the processes that are involved in the IAT. This was the first experiment that was conducted for this thesis. At the time we were not as careful in our formulations and descriptions.

study by Hermans et al. (2000) suggests that affective priming effects are due to relatively efficient processes, in that affective priming effects are even detected under high cognitive load. Affective priming effects with the evaluation task can only be considered unintentional in the sense that participants are not given the instruction to evaluate the primes, and that participants may not intentionally use the valence of the prime to evaluate the valence of the target. The criterion of goal-independency is not met by the affective priming paradigm with the evaluation task. Evidence suggests that affective priming effects with word stimuli might simply be goal dependent. For the features of uncontrollability or unawareness that an attitude is being measured, no direct evidence could be found. It could be argued that when the speeded nature of the task (i.e., short SOA and instructions emphasizing speed) is preserved, participants will hardly have any time for controlled processing, so are unlikely to be able to control the effect. However, this issue remains for further research.

3. Are implicit and explicit attitudes related?

The dual attitude model (Wilson et al., 2000) states that people can hold separate implicit and explicit attitudes, but does not state that they are necessarily uncorrelated. According to the MODE model (Fazio & Towles-Schwen, 1999), a relation between implicit and explicit attitudes depends on motivation and cognitive capacity. In the two systems model (Strack & Deutsch, 2004), the impulsive and the reflective system operate in parallel, and interact at various stages. In the following part of this chapter evidence regarding the correlation between implicit and explicit attitudes will be reviewed, along with evidence for possible moderators of this relationship.

Relatively early research and theorizing suggests that implicit and explicit attitude measures result in distinct evaluations that are expected to be unrelated (see Banaji, 2004). However, a recent meta-analysis showed that the IAT and explicit attitude measures correlate modestly, but consistently (Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2004). Moreover, Hofmann et al. found that the IAT-explicit correlations were significantly moderated by the order of the IAT and the explicit measures, in that higher correlations were found when the explicit measures preceded the IAT (see also Bosson, Swann, & Pennebaker, 2000; but see Egloff & Schmukle, 2003). Possibly, these correlations are higher because the explicit measure gives a hint about what will be assessed in the IAT procedure. Hofmann et al. also found that implicit-explicit correlations were lower for attitudes on socially sensitive subjects, a finding that is consistent with research by Nosek (2004; Nosek & Banaji, 2002). The MODE model would predict this lower correlation because it expects greater degrees of motivation for socially sensitive topics. Furthermore, Hofmann et al. (2004) found a moderating effect of type of self-report measure. They conclude that the IAT and explicit measures should not be considered as fully dissociated.

Nosek (2004) also concludes that implicit and explicit attitudes are distinct but related, and besides finds evidence for four moderators of the implicit-explicit relationship. As mentioned before, his research suggests that the implicit-explicit relation is larger for rather mundane subjects (e.g., attitude towards flowers) than for more socially sensitive subjects (e.g., attitude toward blacks). Moreover, implicit-explicit correlations were larger for stronger attitudes, bipolar attitudes, and attitudes that are perceived as discrepant from the social norm. Nosek emphasizes that self presentational concerns are not the only moderator of the implicit-explicit relation.

4. Are implicit attitudes stable constructs?

As Blair (2002) notes in her review on the malleability of automatic stereotypes and prejudice, the assumption that these implicit attitudes are stable, has contributed to the idea that attitudes or evaluations assessed by these indirect measures may represent someone's true attitude or evaluation. However, Banaji (2001) pointed out that both indirect and direct measures (e.g., questionnaires) can be valid indicators of attitudes, "each of a different form of the same attitude object and within the same mind" (p. 136). Like many researchers in the field, she considers the debate about which measure would reflect someone's real attitude futile. Banaji's view (2001) is consistent with the MODE model in that the MODE model states that behavior is predicted by explicit measures when the person is both motivated and has enough cognitive capacity. Spontaneous behavior on the other hand is better predicted by implicit measures.

Notably, the dual-attitude model (Wilson et al., 2000) and the two systems model (Strack & Deutsch, 2004) agree that implicit attitudes can only change slowly. Fazio and Olson (2003; MODE model) briefly discuss that automatic attitudes are thought to develop slowly, but also review some evidence that implicit attitudes that are learned in the past can be changed relatively quickly by new environmental pairings. As Fazio and Olson note, a substantial body of research (e.g., Dasgupta & Greenwald, 2001; Kühnen et al., 2001) now suggests that implicit attitudes are malleable. Blair (2002) provides a very detailed review about the malleability of automatic stereotypes and prejudice. As a first example, using both the IAT and a priming procedure, Lowery, Hardin, and Sinclair (2001) found that participants showed less automatic bias against blacks when the experiment was conducted by a black experimenter, than when it was conducted by a white experimenter. So the presence of either a black or a white experimenter influenced the automatic racial bias. Second, Blair, Ma, and Lenton (2001) used an adaptation of the IAT, and had participants engage in counterstereotypic mental imagery regarding women. This manipulation led to a reduction of the implicit woman stereotype. Third, Rudman, Ashmore, and Gary (2001) used the IAT to compare implicit attitudes prior to and after a prejudice and conflict seminar. Participation in this seminar led to a significant reduction in the anti-black bias. Fourth, Wittenbrink, Judd, and Park (2001) showed that the presentation of a short video clip just prior to a prejudice IAT significantly influenced the IAT, in that a positive portrayal of blacks led to diminished anti-black bias as compared to a negative portrayal of blacks. Moreover, in a second experiment they showed that automatic attitudes can also be influenced 'online'. In an affective priming task, primes were either pictures depicting blacks in a positive environment, or depicting black in a negative environment. Blacks in the positive environment led to positive associations with black, whereas blacks in the negative environment led to negative associations with blacks. Finally, Mitchell, Nosek, and Banaji (2003) showed in five experiments that implicit attitudes are malleable by the context, in that their experiments suggest that the implicit attitude is concerned with the aspect of the attitude object that is rendered most salient by the experimental procedure.

Mitchell et al. (2003) discuss two models that could incorporate this malleability. In the stable-but-malleable view someone's attitude is stable, but can be shifted temporarily upon the encounter of counter-attitude exemplars. The impact of these exemplars will diminish over time. Another view - the view that is supported by the experiments of Mitchell et al. (2003) - is that the attitude object changes by for example the context or the current focus of attention, and not the attitude itself. People can have different attitudes

toward different aspects of an attitude object. In fact, many attitude objects are multiply categorizable (Smith, Razio, & Cejka, 1996). For example, chocolate can either be seen as a very palatable food or as a very unhealthy food. Dependent on the current situation, chocolate may thus elicit very different attitudes. As Blair (2002) points out, these automatically activated attitudes can either be seen as different representations that are stored in memory that are retrieved upon encountering an attitude object, or as online reconstructions.

5. How are implicit attitudes formed?

All three models that were discussed previously seem to agree that implicit attitudes can be formed by both culture and personal experience, with the MODE model emphasizing personal experience. A first question that may arise is whether it is possible to strictly separate culture and personal experience. Banaji (2001) argues that it is impossible to separate these two, and contends that associations exist in someone's mind, but are shaped and caused by the culture. "Implicit attitudes as I see it, reflect traces of experiences within a culture that have become so integral a part of the individual's own mental and social makeup that it is artificial, if not patently odd, to separate such attitude into 'culture' versus 'self' parts" (Banaji, 2001, p. 139).

Banaji's (2001) viewpoint is not shared by Karpinski and Hilton (2001). They exposed participants to old-positive associations prior to taking an old-young IAT. This manipulation led to a reduced IAT effect, in that associations with the elderly were less negative. Karpinski and Hilton take this as evidence that the IAT assesses the "associations a person has been exposed to in his or her environment rather than the extent to which the person endorses those evaluative associations" (p. 774). However, these findings might better be taken as evidence for malleability, in that another interpretation could be that the environment renders other aspects of the attitude object salient. Though the stereotype 'elderly' has negative connotations, other characteristics of the elderly (wise, kind, and patient) are surely positive. In other words, one's attitude toward the elderly may differ from situation to situation. Karpinski and Hilton's (2001) research does at least show that implicit attitudes are malleable, but the conclusion that the IAT is simply only sensitive to environmental associations may be unwarranted.

Taking a different approach, Olson and Fazio (2004) developed a personalized version of the IAT, because they argue that the original IAT is contaminated by extrapersonal associations (ie., cultural opinion). With IAT measures more anti-black bias is detected than with other indirect measures such as priming, possibly because of a fairly negative portrayal of black in our society. Moreover, blacks do not show an in-group preference on the IAT (Nosek, Banaji, & Greenwald, 2002), arguing against the premise that the IAT measures only personal associations. Olson and Fazio admit that it is hard to separate culture from person, but contend that individuals may hold some attitudes that deviate from culture. For an individual, these culturally determined associations are irrelevant for his personal evaluations but are represented in his memory and will likely influence IAT performance. For example, a person may know that everyone loves peanuts, but if he is allergic to them, his personal attitude toward peanuts will surely not be positive. Their main change in the IAT is using the labels 'I like' and 'I dislike' instead of the standard labels 'pleasant' vs. 'unpleasant' for the attribute dimension of the IAT. In various experiments, this personalized IAT reveals a reduced anti-black bias, and correlates more strongly with explicit measures. The

original IAT and personalized IAT did correlate moderately, which suggests that also the original IAT is influenced by personal associations. Olson and Fazio (2004) speculate that the personalized IAT may correlate more strongly with priming measures than the traditional IAT.

Nosek and Hansen (2004) argue against Olson and Fazio's (2004) interpretation. Their main point is that the original IAT and the personalized IAT each capture unique aspects of the attitude construct. Attitudes are necessarily a product of the method of measurement. The responses obtained in different paradigms may differ, but that reflects the dimensionality of the attitude construct. Their most important finding is that both the original IAT and the modified IAT are significant predictors of explicit measures when entered simultaneously in a regression. Moreover, original IAT performance did not correlate with measures of cultural associations. They conclude that both IAT measures simply capture different aspects of the attitude construct. A distinction between cultural and personal evaluations is considered impossible and unnecessary. Nosek and Hansen propose to view all associations in memory as relevant for attitudes. The specific attitude that is activated depends on the situation and the measure that is employed (c.f. Mitchell et al., 2003 and previous discussion on malleability). Another possibility - not proposed by Nosek and Hansen - is that different measures may be more or less valid or reliable in assessing the attitude construct, instead of assessing different aspects of the attitude construct.

SUMMARY AND CONCLUSIONS

In line with Fazio and Olson (2003) and De Houwer (in press), a measure can objectively be considered indirect, because an attitude is assessed without directly asking the participant to report this attitude. Which criteria of automaticity are met is considered an empirical question. In this chapter we reviewed empirical evidence regarding the features of automaticitiy for the three paradigms that are used in this thesis. Certainly not all criteria of automaticity are met by these paradigms, and not every paradigm meets the same criteria. For now it is better to speak of relatively automatic processes, and to specify which criteria for automaticity are met by the measure that is used. The term 'implicit' is not specific enough, and carries the notion of 'unaware'. The term 'implicit attitude' may even suggest that people are unaware of the attitude itself. What is often actually meant is that the attitude is automatically activated, and that people may be unaware of the assessment or origin of the attitude.

Interestingly, indirect and direct measures are distinct but moderately correlated. The relation between these two types of measures is moderated by various factors, in that the correlation is higher for rather mundane subjects, stronger attitudes, bipolar attitudes, and attitudes that are perceived as discrepant from the social norm (Hofmann et al., 2004; Nosek, 2004; Nosek & Banaji, 2002). Moreover, though early theorizing suggested that implicit attitudes are stable, a substantial body of research (see Blair, 2002) now suggests that these attitudes - as assessed by indirect measures like the affective priming paradigm and the IAT - are strongly influenced by the situation. This likely means that an attitude object (e.g., chocolate) has many 'faces', and the situation determines how we exactly view it. The issue of whether the attitude is retrieved from memory or is constructed on the spot is as yet unresolved (Blair, 2002). Finally, how implicit attitudes are formed remains a question for now. Theorists agree that both culture and personal experience shape attitudes.

The debate concentrates on whether it makes sense to separate these two (Banaji, 2001; Nosek & Hansen, 2004; Olson & Fazio, 2004).

IMPLICIT AND EXPLICIT ATTITUDES TOWARD HIGH-FAT FOODS IN OBESITY

3

This study examined implicit and explicit attitudes toward high-fat foods in obese (n = 30) and normal-weight controls (n = 31). The Implicit Association Test (A. G. Greenwald, D. E. McGhee, & J. L. K. Schwartz, 1998) was used to measure the differential association of the 2 target categories-high-fat vs. low-fat food words-with an attribute dimension (positive vs. negative). Results suggest that obese people are characterized by a significantly stronger implicit negative attitude toward high-fat foods than are normal-weight controls. This implicit negative attitude is contradictory to their preferences and behavior: Several studies indicate that obese people prefer and consume high-fat foods. Apparently, obese people like the taste of high-fat foods but not the fat content itself, not only on the explicit but also on the implicit level.

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One of the main questions in obesity research is how people become obese. Various food studies have shown that obesity is more strongly related to the percentage of fat in a diet than to total energetic intake: Obese people's diets contain considerably more fat than the diets of normal-weight people (e.g., Capaldi, 1996; Drewnowski, 1996). The higher fat intake of obese people may be related to their larger preference for high-fat foods: Several studies found that obese people's preference for foods was determined more by fat content than by carbohydrate or sucrose content. Moreover, they showed a larger preference for high-fat foods than did normal-weight controls (e.g., Capaldi, 1996; Drewnowski,1991; Drewnowski, Brunzell, Sande, Iverius, & Greenwood, 1985; Drewnowski & Greenwood, 1983; Drewnowski, Kurth, Holden-Wiltse, & Saari, 1992; Reed, Bachmanov, Beauchamp, Tordoff, &Price, 1997). Taste preferences might be considered evaluative categorizations. Evaluative categorizations such as positive-negative can be fast, preconscious, and automatic (e.g., Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Hermans & Eelen, 1997). Taste preferences can be seen, therefore, as a special kind of automatic evaluative categorization, that is, in terms of palatable and unpalatable. Conceptualizing taste preferences as automatic evaluative categorizations leads to the prediction that the obese will not only show an explicit behavioral response to high-fat foods but also a fast, preconscious, and automatic preference for these foods. In this study, we examined the role of preconscious affective processes in the preference for high-fat foods. In particular, we tested whether obese people show a larger preconscious, automatic, positive response when presented with high-fat food words than do normal-weight controls. If obese participants show an implicit preference for high-fat foods, their preference for high-fat foods might not be changed easily.

Method

Participants

The obese group consisted of 24 women and 6 men (age: M = 46.3 years, SD = 14.8; weight: M = 93.6 kg, SD = 13.7; BMI[1]: M = 33.2 kg/m^2, SD = 4.6, *range* = 27.5- 46.2). The normal-weight control group consisted of 25 women and 6 men (age: M = 40.5, SD = 14.4; weight: M = 62.0 kg, SD = 6.6; BMI: M = 21.7 kg/m^2, SD = 1.4). Participants were recruited by press advertisements, asking for overweight and normal weight people, and were selected from the Maastricht population. The two groups did not differ significantly in age, $t(59) = 1.58$, $p = .12$. Medical conditions were checked in an interview, but none of the participants had to be excluded from the study on the basis of this interview. Data from two extra participants were excluded from analysis because of a high error rate (>20%).

Overview of the Implicit Association Test (IAT)

In the current study, the IAT was used to test the hypothesis that obese people have a positive implicit attitude toward high-fat foods. The following description of the IAT procedure focuses on the key aspects of this task (for a more detailed description, see Greenwald, McGhee, and Schwartz, 1998). In the IAT, participants' task was to categorize the presented stimuli (one at a time) as fast and as accurately as possible, according to a concept or an attribute dimension, by pressing the corresponding key (left or right key).

[1] BMI = body mass index: weight/height^2 (kg/m^2).

Key assignment was counterbalanced over participants. In the first step, high-fat and low-fat food words (concept dimension) were presented (e.g., left = high-fat, right = low-fat). In the second step, positive and negative words (attribute dimension) were presented (e.g., left = positive, right = negative). In the third step, high-fat and low-fat food words and positive and negative words were presented alternately and randomly on the different trials (e.g., left = high-fat/positive, right = low-fat/negative). In the fourth step, the key assignment for the concept dimension was reversed (e.g., left = low-fat, right = high-fat). The fifth step was basically the same as the third step, but now the key assignment for concepts was reversed (e.g., left = low-fat/positive, right = high-fat/negative). The speed of the responses in Steps 3 and 5 is dependent on the strength of the association between target and attribute assigned to the same key (e.g., high-fat and positive). If obese people have an implicit preference for high-fat foods, then it should be easier to respond to both high-fat food words and positive words with the same key. It should be more difficult when this combination is reversed, that is, if they have to respond with the same key to both low-fat food words and positive words.

Stimuli of the IAT

In this study, four sets of 6 stimuli were used: 6 high-fat food words (mean percentage of fat: 31.8, SD = 17.7), 6 low-fat food words (mean percentage of fat: 1.4, SD = 2.0), 6 positive words, and 6 negative words. Positive and negative words were selected according to norms by Hermans and De Houwer (1994; see Appendix). (Details about timing and stimuli selection closely followed Greenwald et al., 1998, and are available on request.) Stimuli were selected randomly and without replacement from each set (unique for each participant). The set from which a stimulus was selected was also determined randomly (unique for each participant in Steps 1, 2, and 4; fixed sequence per block in Steps 3 and 5). Steps 1, 2, and 4 consisted of 48 experimental trials; Steps 3 and 5 consisted of 96 experimental trials.

Explicit Measures

In a second task, the same 12 food words as in the IAT were presented in an explicit preference measure to determine whether implicit and explicit measures diverged. Participants judged palatability on a 9-point scale, which varied from - 4 (very unpalatable) to 4 (very palatable). In a third task, statements about different attitudes and habits concerning the fat content of foods were presented. We developed this questionnaire to examine taste and health aspects of high-fat foods (Drewnowski, 1991). See Table 3.1 for the questionnaire items. Participants judged these items on a scale from 1 (totally agree) to 7 (totally disagree). The Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994) was used to measure the presence and severity of specific eating psychopathology. This questionnaire measures restraint, eating concern, shape concern, and weight concern. The control group only included people with EDE-Q scores not indicative of eating psychopathology according to norms by Wilson and Smith (1989). The final task for the participants was the completion of the Social Desirability Scale (SDS; Crowne & Marlow, 1964). The SDS measures the tendency to answer questions in a socially desirable way. This questionnaire was used as a control for the explicit measures.

Table 3.1 Scores on the explicit attitudes and habits questionnaire concerning high-fat foods.

Attitudes and habits	Mean score		*SD*	
	Obese	Control	Obese	Control
1. High-fat foods taste good	3.45	3.87	1.55	1.93
2. High-fat foods are healthy	5.83	5.71	1.71	1.68
3. I should not eat high-fat foods	2.83	4.10	1.90	1.56
4. In my family, we are careful with high-fat foods	2.50	2.48	1.53	1.61
5. I eat a lot of high-fat foods	4.28	5.03	1.85	1.77

Note. Scale endpoints are 1 (totally agree) and 7 (totally disagree). *SD* = standard deviation.

Procedure

The IAT was explained to participants as a categorization task in which they had to decide as quickly as possible to which category each stimulus belonged. To reduce possible demand characteristics, no further information was given about the purpose of the study. To motivate participants, the experimenter was present in the test room during the IAT. After taking the IAT, participants completed several explicit measures, were interviewed about their medical and dieting history, and their height and weight were measured. Anne Roefs did all of the testing.

Design

The IAT data were analyzed in a 2 × 2 × 2 × 2 analysis of covariance (ANCOVA). Combination (high-fat/positive vs. high-fat/negative) and Order (high-fat/positive followed by high-fat/negative vs. high-fat/negative followed by high-fat/positive) were the two within-subjects variables. The two between-subjects variables were Group (obese vs. control) and Part (1vs. 2). In Part 1, the participant completed the 5 steps (see Overview of the IAT) for the first time; in Part 2, the participant passed through 4 of the 5 steps again, in the following order: 4-5-1-3. All of these procedural variables were counterbalanced over participants. Following Greenwald et al. (1998), key assignment was not included in the design but was counterbalanced over participants. To control for the wide spread in age in our participants, we included the difference score age minus mean age as a covariate.

Results

Prior to analysis, following Greenwald et al. (1998), very short responses (< 300 ms) were recoded to 300 ms, and very long responses (> 3000 ms) were recoded to 3000 ms. Moreover, analyses were conducted only on correct responses (94.1% of the data). After recoding, response latencies were log transformed[2] to stabilize variance and to diminish the influence of outliers. All reported means were adjusted for the covariate of age.

[2] Analyses were also performed on the raw data, but they did not lead to substantially different results or conclusions.

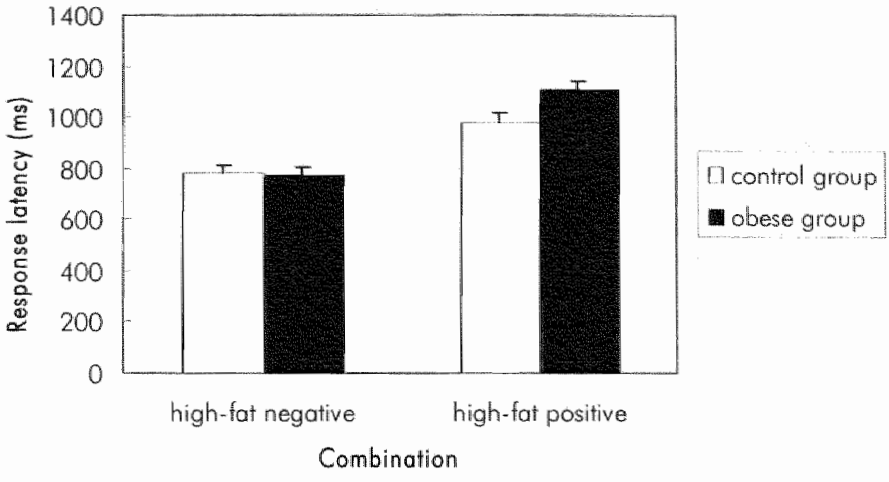


Figure 3.1 Mean response latencies (in milliseconds), measured with the Implicit Association Test (IAT). They have been adjusted for the covariate age and collapsed over order and part. Error bars represent standard errors of measurement.

IAT Effect

Figure 3.1 shows the mean response latencies for the two combination steps (3 and 5). As is apparent from this figure, our results were exactly the opposite of our hypothesis. Both obese and normal-weight controls showed evidence of an implicit negative attitude toward high-fat foods in the IAT paradigm. This main effect of combination was significant in an ANCOVA, $F(1, 56) = 178.28$, $MSE = 0.028$, $p < .001$, $\eta^2 = .76$. It was easier for them to respond with the same key to the combination of high-fat food words and negative words: obese, mean RT = 775 ms ($SEM = 30.4$); normal weight, mean RT = 780 ms ($SEM = 29.9$), as opposed to the combination of high-fat food words and positive words: obese, mean RT = 1,107 ms ($SEM = 38.0$); normal weight, mean RT = 980 ms ($SEM = 37.4$).The main effect was qualified by a Combination × Group interaction, $F(1, 56) = 7.89$, $p < .01$, $\eta^2 = .12$. This interaction effect was further explored in two separate ANCOVAs for the combination high-fat/negative and the combination high-fat/positive. For the combination high-fat/negative, the obese group did not differ significantly from the control group ($F < 1$). However, as Figure 3.1 suggests, obese people responded more slowly to the high-fat/positive combination than did controls, $F(1, 56) = 5.20$, $MSE = 0.076$, $p < .05$, $\eta^2 = .09$. The covariate of age had a significant main effect, $F(1,56) = 22.26$, $MSE = 0.117$, $p < .001$, $\eta^2 = .28$, meaning that older people tended to respond more slowly. There was also a trend toward an Age × Combination interaction, $F(1, 56) = 3.35$, $p = .07$, $\eta^2 = .06$. Closer examination of the results revealed that age affected response latencies more in the combination high-fat/positive than in the combination high-fat/negative. This interaction effect could be a consequence of the fact that older people are less capable of suppressing irrelevant information (Hasher & Zacks, 1988), which in this case was their actual implicit attitude toward high-fat foods. Different procedural variables had significant effects. First, participants

were slower when the combination high-fat/negative preceded the combination high-fat/positive (M = 927 ms, SEM = 21.4) as compared with the reversed order (M = 894 ms, SEM = 22.7), $F(1, 56) = 7.64$, $MSE = 0.006$, $p < .01$, $\eta^2 = .12$. Moreover, there was a significant Combination × Order interaction. The effect of combination (the IAT effect) was larger when the combination high-fat/negative (HF -) preceded the combination high-fat/positive (HF +): HF+ M = 1101 (SEM = 29.5) vs. HF - M = 753 (SEM = 19.3), as compared with the reversed order: HF + M = 986 (SEM = 27.0) vs. HF - M = 802 (SEM = 24.0), $F(1, 56) = 61.35$, $MSE = 0.007$, $p < .001$, $\eta^2 = .52$. Such procedural effects are common in IAT studies (Greenwald et al., 1998).

Explicit Measures

On the explicit preference test (scale range = - 4 to 4), participants indicated that they preferred low-fat foods (M = 1.5, SD = 0.88) to high-fat foods (M = 1.1, SD = 1.3). This main effect of fat content was significant in a 2 (Fat Content: high-fat vs. low-fat) × 2 (Group: obese vs. control) ANOVA, $F(1, 59) = 5.53$, $MSE = 0.929$, $p < .05$, $\eta^2 = .09$. The main effect of group was not significant, $F(1, 59) = 1.33$, $MSE = 1.55$, $p = .25$, nor was the interaction effect ($F < 1$). Table 3.1 contains the mean scores on the questionnaire about explicit attitudes and habits concerning high-fat foods. Obese people and controls differed only in their scores on the third statement, 'I should not eat high-fat foods': M = 2.8 (SD = 1.9) vs. M = 4.1 (SD = 1.6). Obese people were more convinced that they actually should not eat high-fat foods, $t(59) = 2.85$, $SEM = 0.44$, $p < .01$. The EDE-Q total scores of the obese group (M = 1.98, SD = 1.16) differed significantly from the control group (M = 0.27, SD = 0.27), $t(27.4) = 7.29$, $SEM = 0.23$, $p = .001$. The EDE-Q total scores of the obese group were a little high relative to norms reported by Fairburn and Cooper (1993). Scores of the control group were a little lower than norms reported by Cooper, Cooper, and Fairburn (1989) and Fairburn and Cooper (1993). The EDE-Q score correlated significantly with Statement 3, 'I should not eat high-fat foods' (r = - .47, $p < .001$) and Statement 4, 'In my family, we watch our fat intake' (r = - .32, $p < .01$). None of the explicit measures correlated significantly with the SDS.

IAT Compared With Explicit Measures

In the first explicit task, palatability was measured, comparing high-fat foods with low-fat foods. These palatability measures did not correlate significantly with the IAT effect ($p > .20$). In the second explicit task, different attitudes and habits concerning high-fat foods were measured. Only Statement 3 ('I should not eat high-fat foods') correlated significantly with the IAT effect (r = - .26, $p < .05$). EDE-Q total score correlated significantly with the IAT effect as well (r = .24, $p < .05$). Scores on the subscales Restraint (r = .26, $p < .05$), Weight Concern (r = .27, $p < .05$), and Shape Concern (r = .27, $p < .05$) correlated significantly with the IAT effect, whereas the scores on the subscale Eating Concern did not (r = .14, $p > .10$). Finally, the number of diet attempts correlated significantly with the IAT effect (r = .35, $p < .01$).

Discussion

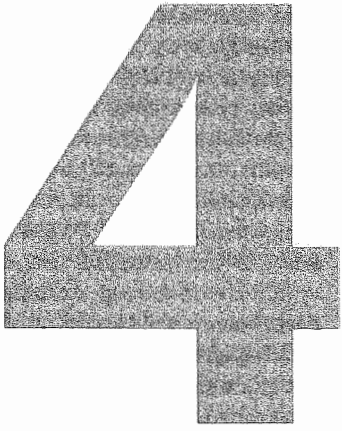
The hypothesis was that obese people would show a larger preconscious, automatic, positive response when presented with high-fat food words than would normal-weight controls. The automatic positive response to high-fat foods would be an implicit expression of

obese people's explicit preference for high-fat foods, which has been shown in various studies (e.g., Capaldi, 1996; Drewnowski, 1991; Drewnowski et al., 1992; Reed et al., 1997). However, our results showed that obese people found it easier to respond with the same key to the combination of high-fat food words and negative words as compared with the reverse combination. These results suggest an implicit negative attitude toward high-fat foods. The same was true for normal-weight controls, but the effect was less pronounced; their responses suggested a smaller negative attitude toward high-fat foods. We uncovered an interaction between group and fat-valence combination. Unpackaging this interaction revealed that obese individuals were significantly slower than controls in responding to the combination of high-fat and positive words. This suggests that it was more difficult for obese people to create a positive/high-fat merged set or linkage. These implicit data correspond to the findings on explicit tests that showed that participants had rather negative views about high-fat foods and reported preferring low-fat foods to high-fat foods. This was true for obese people in particular. However, these latter results should be interpreted with caution because of possible socially desirable responses. Why do obese participants show explicit as well as implicit negative attitudes toward high-fat foods, whereas they actually eat more high-fat foods? In De Houwer's (2001, 2003) studies, he showed that IAT effects reflect attitudes toward the concept dimension and not toward the individual exemplars of this concept dimension. In the current study, it means that the IAT effect does not reflect a global attitude toward each of the food stimuli but rather an attitude specifically toward the fat content of these stimuli. In other words, the IAT in our study measured the association between the dimensions of high-fat/low-fat and positive/ negative. Obese people probably learned in their often numerous diet attempts that high-fat foods are 'forbidden,' even though they like the taste. It is quite possible that this intense learning even showed on an implicit task, which specifically focused on the fat content of foods. More evidence for this line of reasoning can be found in the significant correlations between the IAT effect and the number of diet attempts, the EDE-Q scores, and the explicit attitudes and habits concerning high-fat foods. Moreover, no significant correlations were found between explicit tests for taste preferences and the IAT effect. Swanson, Swanson, and Greenwald (2001) found similar results for smokers in their study. Their findings suggest that smokers have an implicit negative attitude toward smoking; smokers preferred non-smoking to smoking. This implicit negative attitude is contradictory to their behavior of smoking. Note that the IAT is only one operational definition of one sort of implicit processes. The IAT assumes that attitudes are bipolar in nature and directs participants' attention toward one salient aspect of the stimuli (in this study, fat content). It is quite possible that if the implicit attitude toward high-fat foods were measured in a different paradigm that was not bipolar in nature and did not focus attention on fat content, different results would emerge (e.g., affective priming paradigm; Fazio et al., 1986). To summarize, in this study we measured conscious (explicit) and automatic (implicit) evaluations of high-fat food items of obese and normal-weight participants. The IAT only targeted the implicit attitude toward one relevant feature (fat content) of the targets (De Houwer, 2001, 2003). Results suggest that both obese and normal-weight controls have an implicit as well as an explicit negative attitude toward high-fat foods. This effect was more pronounced for obese people. To further our understanding of these results, an interesting avenue for future research would be to examine these implicit attitudes in different paradigms and contexts.

Appendix: Stimuli (translated from Dutch)

high-fat	low-fat	positive	negative
potato chips	popcorn	love	crime
french fries	rice	smile	hate
peanut butter	jelly	kiss	torture
chocolate	licorice	friend	war
ice cream	strawberries	holidays	murder
sausage	chicken	peace	accident

AT FIRST SIGHT: HOW DO RESTRAINED EATERS EVALUATE HIGH-FAT PALATABLE FOODS?



Two experiments tested the hypothesis that restrained eaters display a greater liking for high-fat palatable foods, than do unrestrained eaters. This hypothesis was tested in the affective priming paradigm (Fazio, Sanbonmatsu, Powell, & Kardes, 1986) and in the Extrinsic Affective Simon Task (De Houwer, 2003b). Both paradigms were successful in uncovering food likes and dislikes, and both showed that participants were able to evaluate the palatability of foods relatively automatically. However, contrary to the hypothesis, food likes were not substantially affected by fat content, nor were they affected by restraint status. Restrained and unrestrained eaters may like high-fat palatable foods to the same extent, but may differ in their craving for these foods.

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What determines which foods people choose to consume? This question is difficult to answer given the many factors that could influence food choice (Mela, 1999, 2001), factors such as palatability, health concerns, and availability. One of the most important of these factors seems to be the palatability (liking) of the food (Eertmans, Baeyens, & Van den Bergh, 2001), a factor that affects almost everyone. Moreover, there may also exist individual differences in the liking of foods, governed by such characteristics as one's body weight and the extent to which one desires to control that weight. In the current research we are interested in precisely those individual differences in food liking. The first question that arises is how these differences can best be measured.

Some studies (e.g., Gerding & Weinstein, 1992) have been conducted in which participants were simply asked to report what kinds of food they like. An obvious disadvantage of this kind of measures is that socially desirable answering tendencies can be fairly strong. It might not be easy to admit a liking for high-fat foods in a society in which being slim is considered very important, and in which obesity is stigmatized (Puhl & Brownell, 2003; Teachman & Brownell, 2001). To try to overcome the disadvantages of questionnaires, Lamote, Hermans, Baeyens, and Eelen (2004) used an indirect measure to assess food likes and dislikes. More specifically, they used the affective priming paradigm (Fazio, Sanbonmatsu, Powell, & Kardes, 1986) to study food likes and dislikes in a healthy population. The results of their study suggest that the affective priming paradigm is a suitable measure to uncover people's food likes and dislikes.

The affective priming paradigm is one of the indirect measures that have recently become very popular in clinical psychology (e.g., Palfai & Ostafin, 2003; Sherman, Rose, Koch, Presoon, & Chassin, 2003) and social psychology (e.g., Dovidio, Kawakami, & Gaertner, 2002; Fazio, Jackson, Dunton, & Williams, 1995). In this paradigm (Fazio et al., 1986; Klauer & Musch, 2003) two stimuli are presented in quick succession, a prime followed by a target. No response is required to the prime, which is simply displayed and replaced by the target. Participants have to respond to the target by evaluating it in terms of it is associated with positive versus negative affect. The dependent variable is the positive/negative key-press latency in response to the target.

The focus of the priming paradigm is on the extent to which the presentation of the prime influences the response to the target. Typically (e.g., Bargh, Chaiken, Govender, & Pratto, 1992; Fazio et al., 1986; Hermans, De Houwer, & Eelen, 1994, 2001), affectively congruent prime-target pairs (e.g., 'love' - 'happy') lead to shorter response latencies to the target word than do affectively incongruent prime-target pairs (e.g., 'love' - 'awful'). This in itself is not surprising, and is consistent with semantic priming effects more generally (see Neely, 1991). The critical idea is that the pattern of response latencies as a function of affect match between prime and target indicates how people evaluate the prime on a fairly automatic level. Applied to the palatability of food, if people respond faster on congruent trials ('palatable - positive' and 'unpalatable - negative') than on incongruent trials ('palatable - negative' and 'unpalatable - positive'), it can be inferred that they like palatable foods more than unpalatable foods. The main advantage of employing such indirect measures is that they can estimate people's evaluations of various stimuli without directly asking (Fazio & Olson, 2003), thereby possibly reducing the risk of socially desirable answering tendencies. Responses are assumed to be relatively automatic in this kind of task, because stimuli are presented in quick succession and participants are urged to respond as quickly as possible, leaving insufficient time for controlled processing[1] (Hermans et al., 2001a). Whereas Lamote et al. (2004) showed that the affective priming paradigm is useful for

assessing food likes and dislikes in general, the major aim of the current experiments is to study whether this paradigm and a related indirect measure are sensitive to individual differences between restrained and unrestrained eaters in food likes and dislikes. Heatherton, Herman, Polivy, King, and McGree (1988, p. 19) define restrained eaters, as selected by the Restraint Scale (Herman & Polivy, 1980), as dieters who "exhibit periods of restraint punctuated by episodes of disinhibited overeating." Thus, restrained eaters have the intention of controlling their weight, but often fail and indulge in high-fat palatable foods that they normally do not allow themselves to eat (Herman & Polivy, 1980; Herman & Polivy, 2004). As Gendall and Joyce (2001) suggest, the eating behavior of restrained eaters might enhance the attractiveness of these normally forbidden foods, because of psychological frustration and temporary deprivation. Although evidence is not unequivocal, several self-report studies (e.g., Gendall, Joyce, Sullivan, & Bulik, 1998; Pelchat, 1997) found more craving in restrained as compared to unrestrained eaters. Moreover, some studies (Herman, Polivy, Klajner, & Esses, 1981; Klajner, Herman, Polivy, & Chhabra, 1981; Legoff & Spigelman, 1987) found evidence for stronger physiological reactivity toward food cues in restrained than unrestrained eaters, though again evidence is not unequivocal (e.g., Nederkoorn & Jansen, 2002). The current studies will investigate whether this possibly greater craving and physiological reactivity in restrained eaters is accompanied by a greater liking of these foods on a relatively automatic level.

Prior research in our laboratory also focused on individual differences in food likings, but used another indirect measure (Roefs & Jansen, 2002), the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). Contrary to the hypothesis that an obese group would have a stronger liking of high-fat foods than of low-fat foods as compared to a lean control group (see e.g., Drewnowski, Brunzell, Sande, Iverius, & Greenwood, 1985; Rissanen et al., 2002), both groups showed more negative associations with high-fat foods than with low-fat foods, with this effect being more pronounced for the obese group. The unexpected results of Roefs and Jansen (2002) can probably most easily be explained by the specific characteristics of the IAT, in that the fat content of the food is very salient for participants in this task. The results of De Houwer's studies (2001; 2003b) suggest that IAT effects are strongly influenced by the basis of categorization (in our case fat content: high-fat vs. low-fat). It is perhaps unsurprising that people do not like the fact that their favorite food is high-fat, though they obviously like the taste of it.

The advantage of both the priming task (Fazio et al., 1986) and another, recently developed indirect measure, the Extrinsic Affective Simon Task (EAST; De Houwer, 2003b), is that these tasks do not demand that the food be categorized in terms of fat content, thereby avoiding a specific focus on the fat content (c.f. IAT). Thus, indirect measures may not all assess the same underlying construct (Bosson, Swann, & Pennebaker, 2000; Fazio & Olson, 2003; Olson & Fazio, 2003; but see Cunningham, Preacher, & Banaji, 2001). Because of

[1] Using an indirect measure is not necessarily equivalent to the measurement of an unconscious construct. Participants may be unaware what the task assesses, but that does not necessarily mean that they are unaware of their attitudes or evaluations (Fazio & Olson, 2003). Thus, the term automatic is not equivalent to the term unconscious, but rather means that the employed indirect measures leave insufficient time for participants to strategically control their response. To avoid confusing terminology, we follow Fazio and Olson (2003; see e.g., MacLeod, 1989) in using the term indirect measure instead of implicit measure, and the term direct measure instead of explicit measure, because 'implicit' seems to carry the notion of 'unconscious', while 'explicit' seems to carry the notion of "conscious."

these and other disadvantages of the IAT (De Houwer, 2002) we chose to continue our research on individual differences in food likings using other indirect measures. In Experiment 1, the affective priming paradigm will be employed (Fazio et al., 1986), following the lead of Lamote et al. (2004). In Experiment 2, a recently developed paradigm, the EAST (De Houwer, 2003b), will be employed, to seek convergence and generalization in a different paradigm. Similar to the affective priming paradigm, participants are not required to categorize the foods into pre-defined categories. Both experiments investigate whether restrained eaters display a stronger liking of palatable foods over unpalatable foods than unrestrained eaters, and whether this is specific for high-fat palatable foods, the foods that restrained eaters normally do not allow themselves to eat.

EXPERIMENT 1

Method

Participants

The participants were female introductory psychology students at the University of Toronto. They were selected on the basis of their score on the Restraint Scale (Herman & Polivy, 1980) from a large group of students who had indicated that they would like to participate in research, and they took part either for bonus credit in a course or for $10. Thirty-two participants were classified as restrained eaters, indicated by a score of 15 or higher on the Restraint Scale (age: $M = 19.5$, $SD = 2.0$; self-reported weight (kg): $M = 63.0$, $SD = 10.2$; BMI: $M = 22.9$, $SD = 3.3$, *Range* = 17.1 - 30.8; total score Restraint Scale: $M = 20.0$, $SD = 3.6$). Thirty-seven participants were classified as unrestrained eaters, indicated by a score of 14 or lower on the Restraint Scale (age: $M = 19.5$, $SD = 1.8$; self-reported weight (kg): $M = 55.7$, $SD = 7.7$; BMI: $M = 20.6$, $SD = 2.6$, *Range* = 16.5 - 28.2; total score Restraint Scale: $M = 8.1$, $SD = 3.3$). BMI refers to body mass index, which is simply the ratio of weight to squared height (kg/m^2). The two groups did not differ significantly in age, $t(67) < 1$. However, they did differ in BMI, $t(67) = 3.24$, $p < .01$. The data of one additional participant (restrained eater) were deleted from all analyses because of a high percentage ($> M + 3\ SD$) of trials with errors or responses that were either too slow (>2000 ms) or too fast (<200 ms).

Stimulus selection and timing of trials in the priming task

Stimuli. Sixteen high-fat food words (e.g., 'chocolate') and 16 low-fat food words (e.g., 'melon') served as primes (see Appendix). The two groups of stimuli did not differ significantly in word length (number of letters: high-fat: $M = 6.3$, $SD = 1.4$ vs. low-fat: $M = 6.1$, $SD = 1.5$), $t(30) < 1$. These foods were selected on the basis of both a food table (Nevo Tabel, 1993) and prior research related to food and restraint (McCabe, 1999).

Thirty-two general positive (e.g., 'love') and 32 general negative (e.g., 'dreadful') words served as targets (see Appendix), and were selected according to norms by Bellezza, Greenwald, and Banaji (1986), who had participants rate a large number of words on 5-point scales for pleasantness ('very unpleasant - very pleasant'), visual imagery ('no image at all - very clear and vivid visual image'), and familiarity ('encounter very infrequently - encounter very frequently'). The two groups of stimuli differed significantly in pleasantness (negative: $M = 1.4$, $SD = 0.1$ vs. positive: $M = 4.6$, $SD = 0.1$), $t(62) = 118.29$, $p < .001$.

There were no significant differences between the two groups of stimuli in visual imagery (negative: $M = 3.6$, $SD = 0.5$ vs. positive: $M = 3.7$, $SD = 0.5$), $t(62) < 1$, affective extremity (negative: $M = 1.6$, $SD = 0.1$ vs. positive: $M = 1.6$, $SD = 0.1$), $t(62) = 1.39$, $p = .17$, or word length (negative: $M = 6.4$, $SD = 1.2$ vs. positive: $M = 6.1$, $SD = 1.7$), $t(62) < 1$. However, there was a significant difference in familiarity ratings (negative: $M = 2.8$, $SD = 0.6$ vs. positive: $M = 3.5$, $SD = 0.6$), $t(62) = 4.73$, $p < .001$. Primes and targets were presented in black lower-case letters (6 mm high) against a light background on a computer monitor.

Randomization of stimuli. Each of the 3 blocks consisted of 64 trials, resulting in a total of 192 trials. Each food-stimulus (prime) was paired once with a positive and once with a negative target in each block. All primes had been presented once (with either a positive or a negative target) before any prime was presented for the second time in each block. For each set of two participants (one restrained and one unrestrained eater), and for each of the three blocks, it was determined randomly which half of the high-fat foods and which half of the low-fat foods would be paired first with a positive/negative target. Primes and targets were both randomly selected (uniquely for each participant) from their respective sets without replacement.

Trial timing. The timing of trials was modeled after the procedure of Hermans et al. (2001a). Each trial started with a warning tone (200 ms), followed by a fixation cross (500 ms). Then the prime was presented for 200 ms. After a 150 ms stimulus onset asynchrony (SOA) - the time that elapses between the onset of the prime and the onset of the target - the target was presented on the monitor. Thus, prime and target co-occurred for 50 ms. An SOA of 150 ms was chosen because Hermans et al. (2001a) showed that this SOA was optimal for the expression of affective priming effects. Because of the 50 ms simultaneous presentation, the prime was presented 4.5 mm above the center of the monitor, and the target 4.5 mm below the center of the monitor (as measured to the center-line of the characters)[2] . The target remained on the monitor until a response was given or for 2500 ms if no response was given. If an error was made or a response was either too slow or too fast, or if no response at all was given, a warning appeared on the screen for 300 ms. The inter-trial interval was 2500 ms.

Direct measures

Direct rating task of foods. The 32 foods that were used as primes were presented in random order (identical for all participants) on a paper-and-pencil rating task. Participants were asked to rate the foods on taste (5-point scale: 1: dislike a lot - 5: like a lot).

Direct rank order task. Participants were given two separate lists, one with the high-fat foods (16) and one with the low-fat foods (16), presented in the same random order for all participants. They were asked to rank each list of foods in order of how much they liked the taste, from the most tasty item to the least tasty item. The high-fat and low-fat foods were presented on separate lists to minimize influences of socially desirable answering tendencies. If these two types of food had been presented mixed in one list, participants might have been 'tempted' to give the low-fat foods a better rank, even though they were

[2] Note however that the uncentered presentation mode might have underestimated a possible priming effect involving fat content (Hermans et al., 2001a). This way of presenting stimuli was chosen, because originally this experiment included a second part in which the SOA was varied, but in which the prime presentation was to be held constant at 200 ms.

instructed to pay attention only to the taste of the foods.

This direct ranking task was included specifically for the purpose of stimulus selection for the priming task. Because the palatability of foods likely varies widely among participants (Frank & van der Klaauw, 1994), we decided to determine prime palatability uniquely for each participant. On the basis of the direct rank order task, we selected the 5 most liked items, and the 5 least liked items for each type of food (high-fat and low-fat) for each participant. To prevent the direct ranking task from interfering with the priming task, all primes (32) were initially included in the priming task. In the analyses we used only those trials on which one of the idiosyncratically selected 20 primes appeared (40 trials per block). Selecting primes in this way provided us with 5 high-fat palatable foods, 5 low-fat palatable foods, 5 high-fat unpalatable foods, and 5 low-fat unpalatable foods per participant.

Restraint Scale. The Restraint Scale measures "the extent to which participants showed evidence of dieting and concern about their weight" (Herman & Polivy, 1980, p. 212). The maximum score on this scale is 35, whereas the minimum score is 0.

Procedure

Participants were tested individually in a quiet research room. For the affective priming task, they were instructed to read the first word silently, and then to decide whether the second word was positive or negative, pressing the corresponding key on the key box (key assignment was counterbalanced across participants). They were told to respond as quickly as possible but to avoid making too many mistakes. They were then presented with 16 practice trials using stimulus materials different from those on the experimental trials. Similar to Zack, Toneatto, and MacLeod (1999), they were given a free recall test for the primes immediately after the practice trials, writing down as many words as they could remember that appeared as a first word (prime) on the computer task that they had just performed. This task was included to ensure that participants paid attention to both primes and targets by raising the possibility that participants might be asked to perform such a free recall task later in the procedure. After this memory test, a brief reminder appeared on the monitor concerning how to perform the priming task. Participants were now ready to begin the actual priming task, which was made up of three blocks with a short break after each block.

After the priming task, the participants were again given a free recall test for the primes. Subsequently, a manipulation check was performed, to check whether participants realized what the computer task assessed. Next, participants were asked to perform the rating and rank-ordering of the foods as described in the previous section (direct measures). Their final task was to complete the Restraint Scale.

Apparatus

The experiment was carried out on a Dell Inspiron 5000e notebook computer with a Pentium III processor, connected to a Samsung SyncMaster 750S monitor. Key responses were registered by an external response device with better than one millisecond accuracy. The software controlling the experiment was programmed in ERTS (Experimental Run Time System, Beringer, 1996).

Design and analysis

Data were analyzed using a 2 (target affect: positive vs. negative) × 2 (fat-content prime:

high-fat vs. low-fat) × 2 (palatability of prime: palatable vs. unpalatable) × 2 (group: restrained vs. unrestrained) analysis of variance (ANOVA), with repeated measures on the first three factors. An interaction between prime and target indicates that there is a priming effect (i.e., that the presentation of the prime influenced the speed and accuracy of responding to the target). Before analyzing the data, we discarded responses that were either too fast (< 200 ms) or too slow (> 2000 ms), a total of only 0.19% of all trials. Response latencies associated with error responses (4.5%) were also discarded. All reported analyses are for response latencies as the dependent variable. Analyses on error percentages will not be reported because they did not produce relevant significant results.

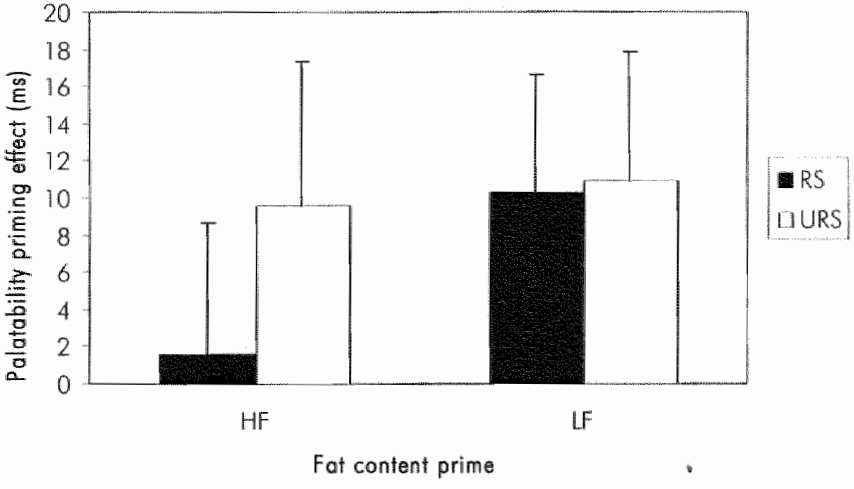

Figure 4.1 Experiment 1: The palatability priming effect as a function of participant group (restrained vs. unrestrained eaters) and fat content of the prime. The palatability priming effects for each participant and separately for high-fat and low-fat foods are computed as: ((mean (palatable-) + mean (unpalatable+)) / 2) - ((mean (palatable+) + mean (unpalatable-)) / 2). In this formula, 'palatable' or 'unpalatable' indicate the palatability of the prime, whereas the plus or minus sign right behind it, indicate whether the target was positive or negative. A positive score indicates a liking of palatable foods over unpalatable foods, and a negative score indicates a liking of unpalatable foods over palatable foods. Error bars represent one standard error. *Note*: RS = restrained eaters; URS = unrestrained eaters; HF = high-fat food; LF = low-fat food.

Results

Affective priming task

The speed of the response to the target was influenced by the palatability of the prime in the expected direction: Participants were on average faster on congruent (palatable-positive / unpalatable-negative) than on incongruent (palatable-negative / unpalatable-positive) trials (See Figure 4.1). This prime palatability × target affect interaction was significant,

$F(1, 67) = 5.87$, $p < .05$, and qualified main effects of both target affect, $F(1, 67) = 9.48$, $p < .01$, and prime palatability, $F(1, 67) = 5.11$, $p < .05$. This interaction effect (i.e., priming effect) means that participants displayed a liking of palatable foods over unpalatable foods on a relatively automatic level. However, this effect did not seem to be different for the restrained and unrestrained groups, as indicated by the nonsignificant target affect × prime palatability × group interaction, $F(1, 67) < 1$. Moreover, the fat content did not seem to influence the results. None of the relevant interactions - target affect × prime fat content (× group) and target affect × prime fat content × prime palatability (× group) - were significant, all Fs $(1, 67) < 1.39$. Nor were the main effects of prime fat content, $F(1, 67) < 1$, or group, $F(1, 67) = 1.88$, $p = .18$, significant[3].

Table 4.1 Experiment 1: Mean palatability ratings (1: very unpalatable - 5: very palatable) of the direct rating task. Standard deviations (*SD*) are reported in a separate column. The high-fat and low-fat foods are grouped into palatable and unpalatable foods based on the direct rank order task.

	Mean		*SD*	
Food	RS	URS	RS	URS
HF	3.8	3.8	0.6	0.5
LF	4.1	4.0	0.4	0.5
HF+	4.7	4.7	0.4	0.3
HF-	2.6	2.6	0.9	0.8
LF+	4.8	4.8	0.2	0.3
LF-	3.0	3.0	0.7	0.9

Note. HF = all HF foods; LF = all low-fat foods; HF+ = high-fat palatable foods; HF- = high-fat unpalatable foods; LF+ = low-fat palatable foods; LF- = low-fat unpalatable foods; RS = restrained eaters; URS = unrestrained eaters.

Direct rating task palatability

Data for ratings of all 32 foods were analyzed in a 2 (fat content: high-fat vs. low-fat) × 2 (group: restrained vs. unrestrained) ANOVA. On the direct task, participants in general indicated that they preferred the tastes of low-fat foods to those of high-fat foods, $F(1, 67) = 11.46$, $p < .01$, a finding which may partly reflect disapproval of high-fat foods, rather than

[3] In the reported analyses, one participant was excluded because of a high percentage (> *M* + 3 *SD*) of trials with errors or responses that were either too slow (> 2000 ms) or too fast (< 200 ms). Analyses including this participant did not affect the latency results. In the error analyses however, the target affect × prime palatability × group interaction was marginally significant ($p = .07$). In separate analyses for the two groups, the target affect × prime palatability interaction was not significant for the restrained eaters ($F < 1$), but was marginally significant for the unrestrained eaters ($p = .07$). Unrestrained participants made fewer errors on incongruent trials (palatable prime - negative target / unpalatable prime - positive target) than on congruent trials (palatable prime - positive target / unpalatable prime - negative target).

genuine dislike. Neither the main effect of group, nor the fat-content × group interaction was significant, both Fs(1, 67) < 1 (see Table 4.1).

An analysis was also performed on just the five most palatable high-fat and low-fat items and the five most unpalatable high-fat and low-fat items, to examine whether the high-fat and low-fat foods differed in palatability rating within these extreme fives, in a 2 (palatability: top five palatable vs. top five unpalatable) × 2 (fat content: high-fat vs. low-fat) × 2 (group) ANOVA. The palatability factor was based on the responses on the rank order task. Participants strongly preferred the palatable items over the unpalatable items, $F(1, 67) = 767.33$, $p < .001$, which is in accordance with the findings on the affective priming task. Participants again also preferred the low-fat foods over the high-fat foods, $F(1, 67) = 14.18$, $p < .001$. Moreover, the palatability × fat content interaction was significant, $F(1, 67) = 7.92$, $p < .01$. Further analyses indicate that the effect of fat content was larger for unpalatable items, $F(1, 67) = 13.47$, $p < .001$, than for palatable items, $F(1, 67) = 4.41$, $p < .05$ (See Table 4.1).

EXPERIMENT 2

We sought to corroborate the findings of Experiment 1 in a second experiment, which tested the same hypothesis in a different, converging way. Experiment 2 differed in three important ways from Experiment 1. First, to study whether the findings of Experiment 1 might have been method specific, a different indirect measure, the EAST (De Houwer, 2003b), was used in Experiment 2. Comparable to the affective priming paradigm, this paradigm also does not demand that the food stimuli be categorized in pre-defined categories (high-fat vs. low-fat). Second, in Experiment 2, the palatability factor was determined not only on an individual basis, as in Experiment 1, but also on the basis of a separate pilot study, conducted with a different group of participants. So, using the pilot data, the four groups of stimuli were determined on an a-priori basis. This manipulation permits comparison of these two methods of stimulus selection. The advantage of an idiosyncratic measure of palatability for stimulus selection is that this procedure guarantees that the selected stimuli fit with the participant. The advantage of stimulus selection based on a pilot study is that the stimuli that are used in the analyses are the same for all participants. Finally, a third modification involved how the positive and negative stimuli (in this experiment the white words) were selected. In Experiment 1, the target words were simply general positive and negative words. These sets of stimuli were chosen to avoid biasing the participants, and thus their responses to the primes (foods). In Experiment 2, synonyms of the concepts 'palatable' and 'unpalatable' were used as the white stimuli, in an attempt to make the (un)palatability a salient feature.

Method

Pilot study palatability

The goal of this pilot study was to determine which foods are generally liked and disliked by female university students ($n = 64$). Participants were given a list of 28 high-fat foods and a list of 33 low-fat foods, and were asked to consider each list separately. If high-fat and low-fat foods had been mixed, participants might have been "tempted" to select mainly low-fat foods, because a liking for low-fat foods may be seen as socially desirable. They

were asked to choose from each list the eight foods that they liked most and the eight foods that they disliked most. Then they were asked to rank the eight foods they (dis)liked most from 1 ((dis)like the most) to 8 ((dis)like the least). Stimulus selection was based on the mean ranking of a food, weighted by the number of participants who put that food in their selection of (dis)liked foods. In this way, we selected 5 high-fat liked, 5 high-fat disliked, 5 low-fat liked, and 5 low-fat disliked foods (see Appendix).

Participants

The participants were female students at Maastricht University in the Netherlands. Participants were selected in the same way as in Experiment 1. All participants were paid € 7,50. Twenty-six participants, scoring 15 or higher on the Restraint Scale, were classified as restrained eaters (age: $M = 19.6$, $SD = 2.2$; weight (kg): $M = 69.0$, $SD = 13.2$; BMI: $M = 24.6$, $SD = 4.16$, *Range* = 19.8 - 34.4; total score Restraint Scale: $M = 20.3$, $SD = 4.0$). Thirty participants, scoring 14 or lower on the Restraint Scale, were classified as unrestrained eaters (age: $M = 19.3$, $SD = 1.1$; weight (kg): $M = 63.6$, $SD = 7.8$; BMI: $M = 22.3$, $SD = 2.4$, *Range* = 18.6 - 27.1; total score Restraint Scale: $M = 10.1$, $SD = 2.9$). The experimenter measured body weight and height at the end of the experiment. Two restrained eaters did not want to be weighed, and did not want to report their weight either. The two groups did not differ significantly in age, $t(54) < 1$. They did differ significantly in BMI, $t(34.95) = 2.43$, $p < .05$.

Overview Extrinsic Affective Simon Task (EAST)

In the critical blocks of the EAST (De Houwer, 2003b), white and colored (blue vs. green) stimuli were presented intermixed. Participants had to categorize the white words based on the meaning of these words, and the colored words based on their color. The white stimuli were synonyms of the concept 'palatable' or the concept 'unpalatable'. By assigning one type of white stimuli (e.g., synonyms of 'palatable') to the left response key, and the other type of white stimuli (e.g., synonyms of 'unpalatable') to the right response key, participants extrinsically associated each key with a specific type of stimuli. Key-assignment was counterbalanced over participants.

The colored stimuli were the concepts of interest, and consisted of the same four types of food as in Experiment 1. Each food stimulus was presented once in blue and once in green in each experimental block. The participant was instructed to respond to one color (e.g., blue) with the left response key, and to respond to the other color (e.g., green) with the right response key. Again, key assignment was counterbalanced over participants. In this example, it should be easier for a participant to categorize the color of a palatable food when it is presented in blue rather than green, because both blue food words and white synonyms of the concept 'palatable' map onto the same response key (left). Correspondingly, it should be easier for a participant to categorize the color of an unpalatable food when it is presented in green rather than blue, because both green food words and white synonyms of the concept 'unpalatable' map onto the same response key (right). The dependent variables in this task were the response latency and the percentage of errors. The EAST effect is defined as the difference in response latency and/or error percentages when responding with the extrinsically incongruent key versus the extrinsically congruent key.

Stimulus selection and timing of the trials in the EAST

Stimuli. Five high-fat palatable (HF+), five high-fat unpalatable (HF-), five low-fat palatable (LF+), and five low-fat unpalatable (LF-) foods were selected as colored stimuli, on the basis of the pilot task (see Appendix). These four groups of stimuli did not differ significantly in word length (number of letters: HF+: $M = 6.2$, $SD = 1.8$; HF-: $M = 6.2$, $SD = 1.9$; LF+: $M = 6.4$, $SD = 2.2$; LF-: $M = 7.2$, $SD = 1.1$), $F(3, 16) < 1$.

The white stimuli were 5 synonyms for the concept 'palatable' and 5 synonyms for the concept 'unpalatable' (see Appendix). These stimuli were selected using the online version of the Van Dale Dictionary for the Dutch language. The two groups of stimuli did not differ significantly in word length (number of letters: synonyms palatable: $M = 8.0$, $SD = 2.7$; synonyms unpalatable: $M = 8.4$, $SD = 3.4$), $t(8) < 1$. Stimuli were presented against a black background. Following De Houwer (2003a), using the RGB color system, the blue color was defined as 0% red, 38% green, and 46% blue, whereas the green color was defined as 0% red, 46% green, and 38% blue. The resulting blue and green colors were distinguishable but rather similar, as was intended.

Randomization of stimuli. In the first block, the ten white words were presented twice in a random order unique for each participant. Stimuli were drawn without replacement, and the set was initialized when it was empty. In the second block, each food word was presented once in a random order unique for each participant. Half of the foods were presented in green, the other half in blue. The color (blue or green) of the presented stimulus was also determined randomly and was unique for each participant.

The four experimental blocks followed, in each of which there were 20 white trials and 40 colored trials. The colored trials were the crucial trials, and all food words were presented once in each color, in each block. All words were presented once in either green or blue before any words were presented for the second time in the other color. For each pair of two participants (one restrained and one unrestrained eater), and for each of four experimental blocks, it was determined randomly which half of the stimuli would be presented first in green, and which half would be presented first in blue. Again, all stimuli were drawn randomly from their respective sets without replacement, unique for each participant and each block. Sets were initialized when they were empty. Following De Houwer (2003a), each test block started with a few warm-up trials (four in the first test block, two in the other three test blocks). Each of the ten white words appeared on one of these warm-up trials. The selection of the white words for the warm-up trials was random (unique for each participant). In each block, half of the warm-up trials were positive and the other half were negative.

Trial timing. The timing of the trials was modeled after that of De Houwer (2003a). Each trial started with a white fixation cross in the middle of the monitor (500 ms). Then the stimulus was presented in the color appropriate for that trial (white, green, or blue), also in the middle of the monitor. The stimulus remained on the monitor until the participant responded, or until 10 seconds had elapsed. The inter-trial interval was 1500 ms. If an error was made, or a response was either too slow (> 3000 ms) or too fast (< 300 ms), or if no response at all was given, a warning appeared on the monitor for 300 ms. We changed the cutoffs in this experiment relative to Experiment 1, to closely follow De Houwer's (2003a) procedure, thereby also generalizing presentation parameters.

Direct measures

The same kind of direct measures were used as in Experiment 1. Of course, this time, only

the 20 foods that appeared in the EAST were presented on these direct measures. In the paper-and-pencil rating task, participants were asked to rate the foods on taste (7-point scale: dislike a lot - like a lot).

The ranking task was the same as in Experiment 1 and was used as an idiosyncratic measure of palatability. EAST data were then analyzed in two ways: with a palatability factor based on the pilot study (all 5 stimuli for each of 4 food types), and with a palatability factor based on this idiosyncratic measure. For the idiosyncratic measure of palatability, the three most palatable and the three most unpalatable high-fat and low-fat foods were selected for each participant and used in the analyses. A final direct measure was The Restraint Scale (Herman & Polivy, 1980).

Procedure

Participants were tested individually in a quiet, dimly lit research room. First, general instructions were given about which key to press to what kind of stimulus in the EAST. Responses had to be given as quickly as possible, avoiding too many mistakes. Before each block, the relevant instructions were repeated on the monitor. After each block, participants could take a quick break. To control for time of day effects (e.g., time elapsed since lunch or breakfast), average start time of the test session did not differ significantly between the two groups, $t(54) < 1$. After the EAST, participants were asked to perform the rating and rank order task of the foods. Then they were asked to fill out the Restraint Scale. Afterward, participants were briefly asked about their dieting history, eating habits, and medical condition. Finally, the participant's height and weight were measured.

Apparatus

The experiment was carried out on a Dell Optiplex GX 110 computer with a Pentium III processor, connected to a Dell monitor. The same external response device and the same software package as in Experiment 1 were used.

Design and analysis

EAST results were analyzed in 2 (fat content food words: high-fat vs. low-fat) × 2 (palatability food words: palatable vs. unpalatable) × 2 (extrinsic response: synonym palatable vs. synonym unpalatable) × 2 (group: restrained vs. unrestrained eaters) ANOVAs, with repeated measures on the first three factors. An interaction between a food factor and the extrinsic response indicates a significant EAST effect. All analyses were performed on the colored trials only, the trials on which food words were presented. Using the same cut-off values as De Houwer (2003a) did for his EAST studies, responses that were either too fast (< 300 ms) or too slow (> 3000 ms) were discarded, a total of only 0.28% of all trials in the analysis with the pilot based palatability factor, and 0.17% of all trials for the analysis with the idiosyncratic palatability factor. Response latencies associated with error responses (pilot-based: 4.7%; idiosyncratic measure: 4.3%) were also discarded.

Results

EAST - Palatability based on pilot study

Response latencies. No significant effects emerged from this analysis. The EAST effect, palatability × extrinsic response, $F(1, 54) = 2.40$, $p = .13$, was not significant (See Figure 4.2A)

Percentage errors. Unrestrained eaters made fewer errors as compared to restrained eaters, $F(1, 54) = 4.38$, $p < .05$. Moreover, the EAST effect, palatability × extrinsic response was significant and in the expected direction, $F(1, 54) = 8.81$, $p < .01$. On colored trials with palatable items, participants made fewer errors when responding with the extrinsic palatable response than when responding with the extrinsic unpalatable response, $F(1, 54) = 4.92$, $p < .05$, whereas the opposite was true for colored trials with unpalatable items. Participants then made fewer errors when responding with the extrinsic unpalatable response, $F(1, 54) = 5.54$, $p < .05$. However, the EAST effect (palatability × extrinsic response) was not modified by the fat content of the foods, $F(1, 54) < 1$, the restraint-status of the participant, $F(1, 54) < 1$, or an interaction between restraint-status and fat-content, $F(1, 54) < 1$ (See Figure 4.2A).

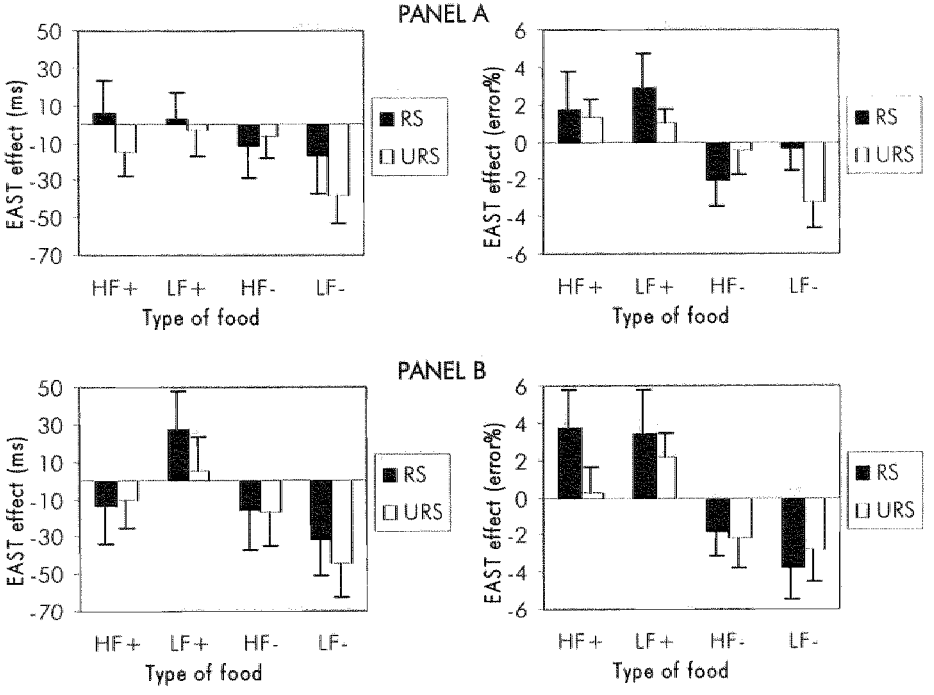

Figure 4.2 Experiment 2: The EAST effect as a function of participant group (restrained vs. unrestrained eaters), palatability of the food, and fat content of the food. The EAST effect (RT and percentage of errors) for each participant and separately for each type of food is computed as: (extrinsic unpalatable response - extrinsic palatable response). A positive score indicates a relative liking of the type of food, whereas a negative score indicates a relative disliking of the type of food. Error bars represent one standard error. Panel A represents the results for the analyses with the palatability factor based on the pilot study. Panel B represents the results for the analyses with the palatability factor based on the idiosyncratic rankings. The left graphs represent the results for the response latencies, whereas the right graphs represent the results for the error percentages. *Note*: RS = restrained eaters; URS = unrestrained eaters; HF+ = high-fat palatable food; LF+ = low-fat palatable food; HF- = high-fat unpalatable food; LF- = low-fat unpalatable food.

EAST - Idiosyncratic measure of palatability

Response latencies. A fat content × palatability × extrinsic response interaction, $F(1, 54) = 6.06$, $p < .05$, qualified a palatability × extrinsic response interaction, $F(1, 54) = 7.77$, $p < .01$. For high-fat foods, the palatability × extrinsic response interaction was not significant, $F(1, 54) < 1$. For low-fat foods, the palatability × extrinsic response interaction was significant, $F(1, 54) = 11.78$, $p < .01$. On colored trials with unpalatable items, participants were faster when responding with the extrinsic unpalatable response than when responding with the extrinsic palatable response, $F(1, 54) = 8.57$, $p < .01$. For palatable items, this main effect of extrinsic response was not significant, $F(1, 54) = 1.63$, $p = .21$ (See Figure 4.2B). This 3-way interaction was not modified by restraint-status, $F(1, 54) < 1$.

Percentage errors. The EAST effect, palatability × extrinsic response, was significant, $F(1, 54) = 12.71$, $p < .01$. On colored trials with palatable items, participants made fewer errors when responding with the extrinsic palatable response than when responding with the extrinsic unpalatable response, $F(1, 54) = 5.97$, $p < .05$, whereas the opposite was true for colored trials with unpalatable items. Participants then made fewer errors when responding with the extrinsic unpalatable response, $F(1, 54) = 9.61$, $p < .01$. However, the EAST effect (palatability × extrinsic response) was not modified by the fat content of the foods, $F(1, 54) < 1.14$, the restraint-status, $F(1, 54) < 1$ or an interaction between fat content and restraint-status, $F(1, 54) < 1$ (See Figure 4.2B).

Direct rating task palatability

Data were analyzed in a 2 (fat content: high-fat vs. low-fat) × 2 (palatability: palatable vs. unpalatable) × 2 (group: restrained vs. unrestrained eaters) ANOVA. The palatability factor was based on the pilot study. Unsurprisingly, the palatable items were judged to be more palatable than the unpalatable items, $F(1, 54) = 318.10$, $p < .001$, which is in accordance with the findings on the EAST. A fat content × palatability interaction, $F(1, 54) = 9.53$, $p < .01$, qualifying the main effect of palatability, suggests that the difference between palatable and unpalatable items was larger for the high-fat foods than for the low-fat foods (See Table 4.2). Again, results were not influenced by the restraint-status of the participants, $Fs(1, 54) < 1.40$.

Table 4.2 Experiment 2: Mean palatability ratings (1: very unpalatable - 7: very palatable) of the direct rating task. Standard deviations (*SD*) are reported in a separate column.

	Mean		*SD*	
Food	RS	URS	RS	URS
HF+	6.0	6.1	0.8	0.6
HF-	3.6	3.9	1.0	1.0
LF+	5.9	5.9	0.5	0.6
LF-	4.2	4.1	1.0	1.0

Note. HF+ = high-fat palatable foods; HF- = high-fat unpalatable foods; LF+ = low-fat palatable foods; LF- = low-fat unpalatable foods; RS = restrained eaters; URS = unrestrained eaters.

GENERAL DISCUSSION

The goal of the current experiments was to test the hypothesis that restrained eaters would be characterized by a stronger liking of (high-fat) palatable foods. To do so, we employed two indirect measures: the affective priming paradigm (Fazio et al., 1986) and the EAST (De Houwer, 2003b), seeking to provide convergence and generalization. In Experiment 1, the affective priming task, participants were faster on congruent (palatable - positive / unpalatable - negative) trials than on incongruent (palatable - negative / unpalatable - positive) trials. In Experiment 2 (EAST), participants responded more accurately to palatable food words when these food words - which had to be categorized based on their color (green vs. blue) - were mapped onto the same response key as synonyms of the concept 'palatable.' Similarly, participants responded more accurately to unpalatable food words when these food words - which had to be categorized based on their color - were mapped onto the same response key as synonyms of the concept 'unpalatable.' Moreover, in Experiment 2, results were not substantially affected by the way that the palatable and unpalatable stimuli had been selected (idiosyncratically vs. pilot study). EAST effects were a little more consistent for the low-fat foods, in that in the RT analyses (idiosyncratic measure of palatability) an EAST effect was only observed for the low-fat foods. In the analyses on error percentages, EAST effects were not influenced by the fat content of the foods.

The results of both experiments suggest that people in general can and do evaluate the palatability of foods quite automatically. The evaluation of the palatability of the food is automatic in the sense that the two paradigms did not allow much time for controlled processing because of the relatively short presentation durations and quick responding. The hypothesis that restrained eaters would show a stronger liking for (high-fat) palatable foods was not supported in either experiment. Note, however, that the conclusion of no differences between restrained and unrestrained eaters hinges on a null-finding, so power may have been a problem. But it is worth noting that the finding that people make this early response toward food based on its taste is consistent with prior research. Hermans, Baeyens, and Lamote (2001) and Lamote et al. (2004) found an affective priming effect for foods based on general liking for these foods.

Why did we not find evidence for the principal hypothesis that restrained eaters would show a stronger liking for (high-fat) palatable foods? If it is assumed that greater craving necessarily is accompanied by greater liking (for a discussion of this assumption, see Berridge, 1996), then the results of the current experiments could be taken as evidence that restrained eaters are not characterized by differential craving responses toward high-fat palatable foods. It could also be that the stimuli - names of foods - that were used in the current studies were not strong enough cues to elicit more craving in restrained eaters as compared to unrestrained eaters, and thus did not lead to differential liking responses.

An alternative explanation can be found in Berridge's (1996) theory of food reward. Though it is often assumed that a craving for a food reflects liking the food, he convincingly argues that this in fact might not always be the case, and that there is no independent evidence for it. He distinguishes between appetite and palatability, a distinction between "the disposition to eat and the sensory pleasure of actually eating" (p. 4). Berridge prefers to use the common word 'wanting' for the motivational effects of appetite and the word 'liking' for the palatability effects. In Berridge's (1996) analysis, people can experience an increase in wanting (craving), without experiencing an increase in liking (increased palatability). Thus, our results could mean that a possibly increased craving response toward

high-fat palatable foods in restrained eaters simply does not go together with a stronger liking for the food, even if this liking is assessed by an indirect measure. These indirect measures may thus tap the palatability or liking of the food independent of craving for that food.

Consequently, it might thus be the case that all people, independent of restraint status, like certain foods to the same extent, but that restrained eaters have a stronger 'wanting' for those foods. An indication that restrained eaters have a stronger 'wanting' of certain foods is that - apart from the studies cited in the introduction suggesting that restrained eaters have more cravings and stronger physiological reactivity to food cues - they often do have a higher weight and a higher energy intake (French, Jeffrey, Forster, McGovern, Kelder, & Baxter, 1994; Jansen, 1996; Stice, 2002). Moreover, as Nederkoorn, van Eijs, and Jansen (in press) recently showed, restrained eaters are more impulsive than unrestrained eaters on a computer task that is unrelated to eating behavior, the stop-signal task (Logan, 1994). As Nederkoorn et al. (in press) suggest, this impulsivity might very well underlie their dysfunctional eating behavior. In other words, restrained eaters might be less able to resist the temptation of palatable food.

Wiers, van Woerden, Smulders, and de Jong (2002) draw similar conclusions from their findings, based on the incentive-sensitization theory (Robinson & Berridge, 2001). This theory resembles Berridge's (1996) theory of food reward. According to Robinson and Berridge (2001), an addiction is driven by a stronger wanting (sensitized arousal) of the drug or alcohol, and not by a greater liking of it. Wiers et al. (2002) used an IAT (Greenwald et al., 1998), and found that heavy drinkers associated alcohol more strongly with arousal than did light drinkers. Heavy and light drinkers did not differ in their valence associations: They invariably associated alcohol with negative affect. "These arousal associations could reflect an appetitive response directed toward the drug" (i.e., alcohol; Wiers et al., 2002, p. 656).

Notably, in the current experiments, we found evidence for positive associations with palatable foods. This was not specific for restrained eaters or for high-fat foods, but - in contrast to the Wiers et al. (2002) study in which negative alcohol associations were found - we found liking of palatable foods over unpalatable foods. Importantly, Wiers et al. (2002) used a different indirect measure, the IAT (Greenwald et al., 1998). As explained in the introduction, these indirect measures often do not correlate strongly (Bosson et al., 2000; Fazio & Olson, 2003; Olson & Fazio, 2003), which might suggest that these paradigms measure different underlying constructs, although reliability and validity are also concerns (Buchner & Wippich, 2000). Thus, the difference in paradigms (IAT vs. affective priming and EAST) might explain why Wiers et al. (2002) - like Roefs and Jansen (2002) - found negative associations with the supposedly craved substance, whereas the current experiments found positive associations.

In sum, palatability, not fat content, determined responding for all individuals, regardless of their restraint status. No evidence was found for the hypothesis that restrained eaters would show a greater liking of (high-fat) palatable foods. If it is assumed that liking a food and craving for a food are necessarily related, these findings could be taken as evidence that restrained eaters are not characterized by stronger craving responses specifically toward high-fat palatable foods, as compared to unrestrained eaters. However, that assumption appears doubtful. The wanting/liking distinction of Berridge (1996) was suggested as a relevant dimension that might help to explain the behavior observed here, in that this theory states that craving and liking might be independent processes. It thus may

be that restrained and unrestrained eaters do differ in craving responses toward high-fat palatable foods, despite liking these foods to the same extent. The employed indirect measures might only be sensitive to liking responses (palatability) and not to potential differences in craving. At any rate, the factors involved in food likes and cravings, and how they interact with the characteristics of the individual eater, clearly represent a complex structure.

Appendix: stimuli

Experiment 1

Positive targets: love, romantic, paradise, pleasure, joy, laughter, cheer, humor, passion, terrific, enjoyment, happy, caress, cuddle, honest, life, freedom, hug, peace, liberty, treasure, triumph, loyal, sweetheart, truth, warmth, cozy, glory, reward, flower, talent, honor.

Negative targets: killer, torture, devil, rape, brutal, funeral, murderer, bastard, morgue, poison, burial, dreadful, suicide, agony, failure, hatred, poverty, terrible, abuse, unhappy, accident, hostage, despise, disaster, bankrupt, jail, filth, slime, violent, grief, waste, tragedy.

High-fat foods: bacon, cake, cheese, chips, chocolate, coconut, cookie, donut, fries, fudge, hamburger, herring, nachos, pancake, peanuts, walnuts.

Low-fat foods: apple, banana, bread, broccoli, cabbage, fruit, juice, melon, radish, popcorn, rice, spinach, strawberry, tomato, turkey, yogurt.

Experiment 2

Synonyms palatable: smakelijk (palatable), heerlijk (delicious), lekker (tasty), verrukkelijk (delectable), zalig (yummy)

Synonyms unpalatable: vies (vile), smerig (nasty), afschuwelijk (horrible), walgelijk (disgusting), onsmakelijk (unpalatable)

High-fat palatable foods: chocola (chocolate), chips (chips), friet (fries), croissant (croissant), pizza (pizza)

High-fat unpalatable foods: haring (herring), speklap (slice of bacon), pate (pate), boter (butter), pindakaas (peanutbutter)

Low-fat palatable foods: aardbeien (strawberries), druiven (grapes), meloen (melon), kip (chicken), popcorn (popcorn)

Low-fat unpalatable foods: spruiten (Brussels sprouts), witlof (chicory), zuurkool (sauerkraut), andijvie (endive), radijs (radish)

EARLY ASSOCIATIONS WITH FOOD IN ANOREXIA NERVOSA PATIENTS AND OBESE PEOPLE ASSESSED IN THE AFFECTIVE PRIMING PARADIGM

Two experiments are reported that used the affective priming paradigm (Fazio, Sanbonmatsu, Powell, & Kardess, 1986) to uncover associations with food at a relatively automatic level. Experiment 1 tested the hypothesis that Anorexia Nervosa (AN; $n = 22$) patients would show less sensitivity to the palatability of foods than unrestrained lean controls ($n = 27$). Results indeed suggested that AN patients did not display a liking of palatable foods over unpalatable foods, whereas unrestrained controls did. Experiment 2 tested the hypothesis that obese people ($n = 27$) would show more sensitivity to the palatability of (high-fat) palatable foods than unrestrained lean controls ($n = 27$) would. However, results suggested that the priming effect was based on health concerns, in that participants showed a preference for low-fat palatable foods over high-fat palatable foods. Average speed of responding and context are discussed as variables influencing the affective priming effect. Taken together, results suggest that food evaluations at a relatively automatic level are controlled by an interaction between participant characteristics, stimuli characteristics, and the specific context.

Roefs, A., Stapert, D., Isabella, L. A. S., Wolters, G., Wojciechowski, F., & Jansen, A. (in press). Early associations with food in anorexia nervosa patients and obese people assessed in the affective priming paradigm. *Eating Behaviors*.

Ideally people consume the foods they like when hungry, while at the same time pay attention to the healthiness of the foods and suitable portion size, resulting in a balanced, healthy and palatable diet. However, several groups of people can be identified for whom food is more troublesome than that. An example is the growing proportion of obese people in the Western society (Wadden, Brownell, & Foster, 2002). Obesity at least partly results from overconsumption of high-fat (palatable) foods (Hill & Peters, 1998). For obese people, high-fat palatable foods may be extra desirable (e.g., Rissanen et al., 2002). A very different group of people is formed by patients diagnosed with anorexia nervosa (AN). They are underweight and thus seem very 'successful' at restricting their food intake. As Pinel, Assanand, and Lehman (2000) propose, this severely reduced food consumption could be related to a reduction of the positive incentive value of foods. In other words, food may have become less desirable.

So, different eating styles or disorders may lead to differences in how people evaluate food, or what kind of associations they have with food. In the current research we are interested in how this might translate to relatively automatic associations with food for both AN patients (Experiment 1) and obese people (Experiment 2). Prior research in our laboratory with restrained and unrestrained eaters (Roefs, Herman, MacLeod, Smulders, & Jansen, in press) and a recent study by Lamote, Hermans, Baeyens, and Eelen (2004) suggest that people make relatively automatic associations with foods based on their palatability. More specifically, results are indicative of a liking of palatable foods over unpalatable foods, at a relatively automatic level.

In these recent studies (Lamote et al., 2004; Roefs et al., in press), the affective priming paradigm (Fazio, Sanbonmatsu, Powell, & Kardes, 1986) was used. In this paradigm, two words (a prime followed by a target) are presented in quick succession. Participants just read the briefly presented prime, and only need to respond to the successively presented target. The idea behind this paradigm is that the presentation of the prime influences the speed and accuracy of responding to the target. Typically, congruent prime-target combinations (e.g., fun - flowers or disaster - death) lead to faster and more accurate responses than incongruent prime-target combinations (e.g., fun - death or disaster - flowers) (e.g., Fazio et al., 1986; for a review, Klauer, 1998). The difference in response latencies (speed) or error percentages (accuracy) between incongruent and congruent trials is called the priming effect. The pattern of response latencies is informative regarding the positive and negative associations people have with the primes. Applied to the palatability of foods, if people respond faster on congruent trials (palatable prime - positive target or unpalatable prime - negative target) than on incongruent trials (palatable prime - negative target or unpalatable prime - positive target), it can be inferred that people like palatable foods more than unpalatable foods, and thus evaluate the palatability of foods at a relatively automatic level.

The affective priming paradigm is one of the so-called indirect measures that have recently been used quite often in psychopathology research (De Houwer, 2002). The advantages of using an indirect measure are twofold. First of all, these indirect measures can estimate people's responses toward various stimuli without directly asking them, thereby reducing the risk of socially desirable answering. Second, responses are assumed to be relatively automatic in these kinds of tasks (Klauer, 1998), because stimuli are presented only briefly and in quick succession. This relatively spontaneous association might deviate from an association that results from more controlled processing[1].

EXPERIMENT 1

Many people attempt to diet, but eventually most dieters cannot resist the temptation of palatable foods. AN patients on the other hand seem very capable of resisting the temptation of palatable foods. You could even call them extremely 'successful' dieters. According to the positive-incentive theory (Hetherington & Rolls, 1996; Toates, 1981) people start eating because of the expected pleasure of eating (positive-incentive value of food). Pinel et al. (2000) propose that "the decline in eating that defines anorexia nervosa is likely a consequence of a corresponding decline in the positive-incentive value of food (p. 1113)." Their hypothesis of a declined positive-incentive value is based on the fact that eating can have adverse physiological effects after a period of food deprivation. Their (Pinel et al., 2000) ideas seem consistent with predictions derived from a conditioning account of eating behavior (Jansen, 1998, 2001), although the proposed mechanism of why food may have lost its incentive value is different. The basic idea of the conditioning model of food intake is that cues (e.g., sight, smell, and taste of food or thoughts about the food) that reliably signal food intake (food intake is UCS) can become conditioned stimuli (CS). These conditioned stimuli can in turn trigger conditioned responses, such as salivation and insulin release, also termed cue reactivity. This cue-reactivity is subjectively experienced as craving for food. AN patients may have increasingly fewer of these conditioning experiences because they often only handle food (e.g., cooking) while they mostly avoid eating food. As a result they do not experience the rewarding effects of food as much as other people do. This may lead to an extinction of the conditioned response, and thus a loss of food's positive incentive value.

Supporting these theories, different studies, either using psychophsiological or self-report measures (Lappalainen, Sjödén, Hursti, & Vesa, 1990; LeGoff, Leichner, & Spigelman, 1988, but see Broberg & Bernstein, 1989), found a reduced reactivity to the palatability of food in AN patients or fasting participants. Another line of research mainly focused on the sensitivity to the rewarding effects of food in AN patients. In line with the proposed theory of Pinel et al. (2000), Davis (2001) suggests that AN patients are more anhedonic than normal controls. Anhedonia is defined as a deficit in experiencing pleasure. Davis and Woodside (2002) found higher anhedonia scores in AN patients (see also Davis & Scott-Robertson, 2000), and argue that the high anhedonia scores of AN patients make food less pleasurable and thus restriction easier. It is easier to resist something that does not offer pleasure. The stress associated with extreme dieting then in turn likely leads to even higher anhedonia scores. It might then be hypothesized that also at a relatively automatic level, AN patients show a reduced sensitivity to the palatability of food. In Experiment 1, using the affective priming paradigm (Fazio et al., 1986), the hypothesis was tested that AN patients would show a reduced affective priming effect as compared to a lean control group, because food may have lost its incentive value. In other words, the hypothesis was tested that the palatable - positive and the unpalatable - negative associations would be less strong for the AN group than for the lean control group at a relatively automatic level.

[1] Note that using an indirect measure does not mean the measurement of an unconscious construct. People may very well be aware of their associations, but may not be aware of what the task is assessing (Fazio & Olson, 2003). The term automatic is not meant here as an equivalent of 'unconscious', but is meant to indicate that the employed indirect measure leaves insufficient time for the participants to strategically control their response.

To test whether this effect might be specific for high-fat foods - the foods that are especially threatening for ones figure - stimuli did not only vary in palatability, but also in fat content.

Method

Participants[2]

The anorexia group (AN; DSM 4th ed., APA, 1994) included 19 female anorexia nervosa patients and 3 female patients diagnosed with eating disorder not otherwise specified (EDNOS), anorectic subtype (age: $M = 20.6$, $SD = 6.3$; BMI[3]: $M = 15.7$, $SD = 1.8$; *Range* = 12.4 - 17.51; Restraint Scale: $M = 17.4$, $SD = 5.1$; EDE-Q global score: $M = 3.3$, $SD = 1.2$). The three EDNOS participants met the criterion of being underweight (BMI < 17.51). Sixteen of the AN patients were of the restricting type and three were of the bingeing/purging type. The control group included 27 female lean unrestrained eaters (age: $M = 20.4$, $SD = 5.8$; BMI: $M = 21.9$, $SD = 1.6$; *Range* = 19.3 - 24.2; Restraint Scale: $M = 7.3$, $SD = 2.3$; EDE-Q global score: $M = 0.5$, $SD = 0.4$). Restraint-status was determined on the basis of the Restraint Scale (Herman & Polivy, 1980). A participant qualified as an unrestrained eater when she scored 14 or below on the Restraint Scale. The two groups of participants were matched on age and on time of testing. The groups differed significantly on BMI, Restraint Scale, and EDE-Q - global score, all $ps < .001$.

Stimulus selection and timing of trials in the priming task

Primes. Six high-fat palatable foods (e.g., 'chocolate'), six low-fat palatable foods (e.g., 'strawberries'), six high-fat unpalatable foods (e.g., 'bacon'), and six low-fat unpalatable foods (e.g., 'radish') served as primes (see Appendix). The four groups of primes did not differ significantly in word length, $F(3, 20) < 1$. Palatability was determined on the basis of a pilot study, in which female university students ($n = 64$) were asked to put a list of high-fat foods and a list of low-fat foods on order of palatability.

Targets. Twenty-four general positive (e.g., 'gift') and 24 general negative (e.g., 'pain') words served as targets (see Appendix), and were selected according to word norms by Hermans and De Houwer (1994). The two groups of stimuli obviously differed significantly in pleasantness (negative: $M = 2.0$, $SD = 0.31$ vs. positive: $M = 6.0$, $SD = 0.29$), $t(46) = 46.25$, $p < .001$. There were no significant differences between the two groups of stimuli in affective extremity (negative: $M = 2.0$, $SD = 0.31$ vs. positive: $M = 2.0$, $SD = 0.29$), $t(46) < 1$, or word length (negative: $M = 6.2$, $SD = 2.02$ vs. positive: $M = 6.79$, $SD = 2.13$), $t(46) < 1$. However, a small significant difference in familiarity ratings was found (negative: $M = 4.8$, $SD = 0.45$ vs. positive: $M = 5.1$, $SD = 0.48$), $t(46) = 2.38$, $p < .05$. See Appendix.

[2] Nine additional participants - not included in the groups described below - were tested but were excluded from all analyses. 1 AN participant was excluded because of a high percentage (> M + 3 SD) of trials with errors or responses that were either too slow (> 2000 ms) or too fast (< 200 ms), and four because of weight gain (BMI > 17.9) at the time of testing. Four lean controls were excluded because they were either overweight, underweight, or scored above 14 on the Restraint Scale (weight and restraint-status were determined after completion of the study)

[3] BMI = Body Mass Index = weight / heighth^2 (kg / m^2)

Trial specification. Each of the 3 blocks consisted of 48 trials, resulting in a total of 144 trials. Stimulus presentation was randomized. The timing of trials was modeled after the procedure of Hermans, De Houwer, and Eelen (2001). Each trial started with a warning tone (200 ms), followed by a fixation cross (500 ms). Then the prime was presented for 150 ms. After a 150 ms stimulus onset asynchrony (SOA) - the time that elapses between the onset of the prime and the onset of the target - the target was presented on the monitor. The target remained on the monitor until a response was given or for 2500 ms if no response was given. If an error was made or a response was either too slow or too fast, or if no response at all was given, a warning appeared on the screen for 300 ms. The inter-trial interval was 2500 ms.

Procedure

Participants started with the affective priming task. After 16 practice trials, they were given a free recall test for the primes (see Zack, Toneatto, & MacLeod, 1999). This task was included to ensure that participants paid attention to both primes and targets. After the memory task, the actual priming task began. Subsequently, a manipulation check was performed to check whether participants realized what the computer task assessed. For anorexia patients the final task was to complete the Restraint Scale (Herman & Polivy, 1980). Control participants were asked to fill out the Restraint Scale and the EDE-Q (Fairburn & Beglin, 1994; Fairburn & Cooper, 1993; anorexia patients filled out the EDE-Q at the time of admittance to the eating disorder unit).

Design

Data were analyzed using a 2 (target affect: positive vs. negative) × 2 (fat-content prime: high-fat vs. low-fat) × 2 (palatability of prime: palatable vs. unpalatable) × 2 (group: AN vs. control) analysis of variance (ANOVA), with repeated measures on the first three factors. An interaction between prime and target indicates that there is a priming effect (i.e., that the presentation of the prime influences the speed and accuracy of responding to the target). Note that there can be an interaction between prime palatability and target affect, suggesting an automatic evaluation of taste, and an interaction between prime fat content and target affect, suggesting an automatic evaluation of fat-content. Moreover, these three factors can combine in one interaction, which means that the priming effect might be specific for only one type of food (e.g., only a palatability priming effect for the high-fat foods). Partial eta squared (η^2) is reported as a measure of effect size for all analyses.

Results and Discussion

The reported analyses are for the dependent variable response latency (speed). Analyses on percentages of errors (accuracy) did not produce relevant significant results. Response latencies associated with responses that were either too fast (< 200 ms) or too slow (> 2000 ms) were discarded, a total of only 0.44% of all trials. Response latencies associated with error responses (3.8%) were also discarded. See Figure 5.1 for relevant means and standard errors.

As hypothesized, results suggest that the AN group was not sensitive to the palatability of the food primes in the affective priming task, whereas the control group was. The three-way target affect × prime palatability × group interaction was marginally significant, $F(1, 47) = 3.13$, $p = .08$, $\eta^2 = .06$, and qualified a target affect × group interaction, $F(1,$

47) = 5.13, $p < .05$, $\eta^2 = .10$, a main effect of prime palatability, $F(1, 47) = 6.22$, $p < .05$, $\eta^2 = .12$, and a main effect of group, $F(1, 47) = 5.89$, $p < .05$, $\eta^2 = .11$. In a separate analysis on the AN group it appeared that the palatability of the prime did not influence AN patients' responding to the target, $F(1, 21) < 1$. Results of a separate analysis on the control group suggest that prime palatability did influence the control participants' responding to the target. Control participants tended to be faster on congruent trials (palatable - positive or unpalatable - negative) than on incongruent trials (palatable - negative or unpalatable - positive). This target affect × prime palatability interaction was marginally significant, $F(1, 26) = 3.99$, $p = .056$, $\eta^2 = .13$. Prime fat content did not influence the priming results, as it was not involved in any significant interaction with target affect, all Fs$(1, 47) < 1$.

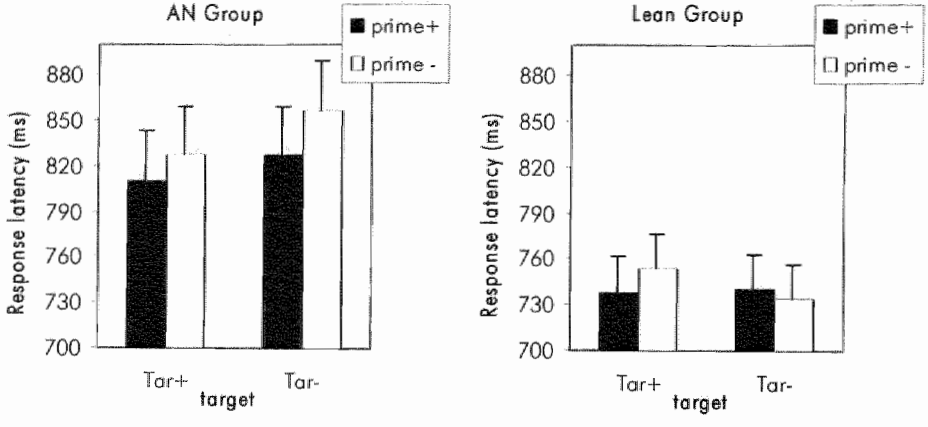

Figure 5.1 Experiment 1: Mean response latencies for the target affect × prime palatability interaction, separately for the AN group and the lean control group. The means are collapsed over the factor prime fat content. Error bars represent the standard error of the mean (SE). The left panel represents the AN group, and the right panel the lean control group. Tar+ = positive target; Tar- = negative target; prime+ = palatable food prime; prime - = unpalatable food prime.

EXPERIMENT 2

For Experiment 2, our hypothesis for the obese group was actually the opposite from our hypothesis for the AN group in Experiment 1. Pliner, Herman, and Polivy (1990) review evidence that obese people are more sensitive to the palatability of foods. In one study for example (Spiegel, Shrager, & Stellar, 1989), obese participants consumed more than lean controls of the highly preferred food, and slightly less than lean controls of the nonpreferred food. In another study (Nisbett, 1968) - that was actually the first to explicitly study obese-lean differences in finickiness - it was found that a palatability manipulation had the greatest effect on the obese people, in that obese people ate more of good-tasting ice cream than lean controls. Obese and lean controls ate about the same amount of the bad-tasting ice cream.

Apart from being more sensitive to the palatability of foods in general, several studies suggest that obese people have a specific preference for high-fat (palatable) foods. Different studies suggest that obese people consume more of their daily calories in fat, although the evidence is not entirely conclusive (Bray & Popkin, 1998; Lissner & Heitmann, 1995; Jéquier, 2002; Willett, 1998). Other studies specifically focused on the preference for high-fat foods, and were supportive of a heightened preference for high-fat foods (e.g., Drewnowski, Kurth, Holden-Wiltse, & Saari, 1992; Gerding & Weinstein, 1992; Rissanen et al., 2002).

Based on these lines of research, Experiment 2 tested the hypothesis that obese people would show a stronger priming effect based on palatability as compared to a lean control group. More specifically, it was hypothesized that the obese group would have stronger positive associations with palatable foods and stronger negative associations with unpalatable foods than a lean control group. Moreover, it was hypothesized that this positive association would be most pronounced for high-fat palatable foods. In other words, it was hypothesized that their stronger preference for palatable foods would be specific for the high-fat foods.

Method

Participants[4]

The obese group included 27 female obese participants (age: $M = 36.5$, $SD = 8.8$; BMI: $M = 40.3$, $SD = 7.4$, *Range* = 30.1 - 65.6; Restraint Scale: $M = 19.3$, $SD = 3.8$), and the control group included 27 female lean unrestrained eaters (age: $M = 36.6$, $SD = 8.7$; BMI: $M = 22.0$, $SD = 1.5$, *Range* = 18.4 - 24.8; Restraint Scale: $M = 8.4$, $SD = 3.2$). The two groups of participants were matched on age and on time of testing. The groups differed significantly on BMI and the Restraint Scale, both $ps < .001$.

The experiment

The specifications of the affective priming task, the direct measures and the procedure were exactly the same as in Experiment 1. The only exceptions being that the EDE-Q (Fairburn & Beglin, 1994; Fairburn & Cooper, 1993) was not included, and that testing took place in a quiet room at a local hospital. For all analyses partial eta squared (η^2) is reported as a measure of effect size.

Results

The reported analyses are for the dependent variable response latency. Analyses on percentages of errors did not produce relevant significant results. Response latencies associ-

[4]Based on beforehand defined exclusion criteria several additional participants - not included in the groups described below - were excluded from all analyses. Six additional participants had medical problems with the thyroid gland. One additional participant was under the influence of alcohol at the time of testing. Two additional participants had a high percentage (> M + 3 SD) of trials with errors or responses that were either too slow (> 2000 ms) or too fast (< 200 ms). Ten additional control participants scored 15 or above on the Restraint Scale or were overweight (BMI > 25) (weight and restraint-status were determined after the participant completed the study).

ated with responses that were either too fast (< 200 ms) or too slow (> 2000 ms) were discarded, a total of only 0.45% of all trials. Response latencies associated with error responses (2.6%) were also discarded. See Figure 5.2 for relevant means and standard errors.

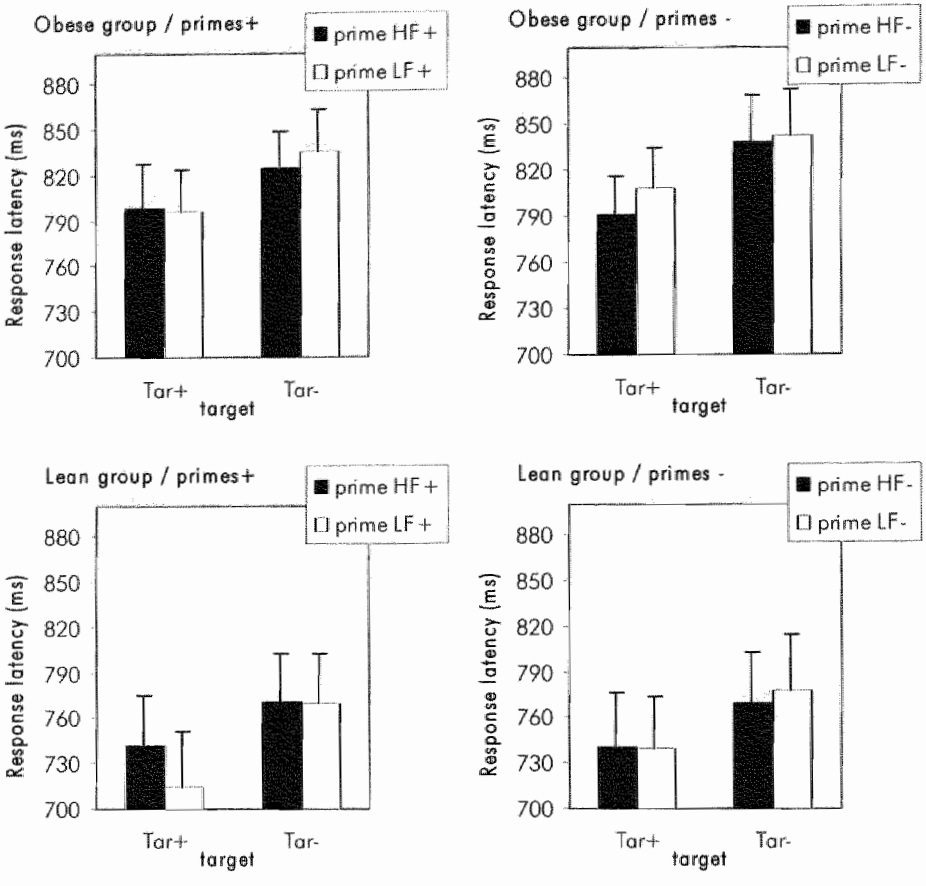

Figure 5.2 Experiment 2: Mean response latencies for the target affect × prime fat content interaction, represented separately for palatable and unpalatable primes, and separately for each group (obese and lean control group). Error bars represent the standard error of the mean (SE). The top two panels represents the obese group, and the bottom two panels the lean control group. Tar+ = positive target, Tar- = negative target, prime HF+ = palatable high-fat food, prime LF+ = palatable low-fat food, Prime HF- = unpalatable high-fat food, Prime LF- = unpalatable low-fat food.

A marginally significant target affect × prime fat content × prime palatability interaction, $F(1, 52) = 3.72$, $p = .06$, $\eta^2 = .07$, qualified a main effect of target affect, $F(1, 52) = 37.92$, $p < .001$, $\eta^2 = .42$. A separate analysis for the palatable food items, suggests that participants preferred low-fat foods over high-fat foods. The target affect × prime fat content interaction for palatable items was marginally significant, $F(1, 52) = 2.98$, $p = .09$, η^2

= .05. This effect suggests that health concerns influenced the priming effect. For unpalatable items, the target affect × prime fat content interaction was absent, $F(1, 52) < 1$. A possible explanation for the different pattern of results for palatable and unpalatable foods may be that people have stronger negative associations with high-fat palatable foods (e.g., chocolate) than with high-fat unpalatable foods (e.g., bacon), because these high-fat palatable foods are exactly the foods that are often craved but considered forbidden in a typical weight loss diet. Results did not differ between groups; none of the interactions involving target affect, prime (fat-content or palatability) and group were significant, all $Fs(1, 52) < 1.07$.

GENERAL DISCUSSION

In line with the proposed theory of Pinel et al. (2000) and the conditioning model of eating behavior (e.g., Jansen, 1998), the AN group did not show a palatability priming effect. They did not display any evidence of positive associations with palatable foods or negative associations with unpalatable foods, when tested in the affective priming paradigm. In line with prior research (e.g., Davis & Woodside, 2002; LeGoff et al., 1988), these results suggest that the palatability of food may no longer be an important characteristic of food for AN patients, whereas this is very important for most people (Eertmans, Baeyens, & Van den Bergh, 2001; Pliner & Mann, 2004). As Pinel et al. (2002) also suggests, this 'symptom' of AN patients makes food restriction easier, in that it is easier to resist something that is not considered pleasurable. Possibly, when AN patients start eating more again - and experience the rewarding effects of food - palatability of food may become important again. This in turn would make food restriction more difficult. It is also possible that a more explicit treatment is necessary to restore palatability as an important characteristic of food. This might for example be achieved by frequently pairing the sight or taste of palatable food with actual consumption (classical conditioning).

As hypothesized, the control group in Experiment 1 did evaluate the palatability of the foods in the affective priming task, in that their results reflected a liking of palatable foods over unpalatable foods. These results are perfectly in accordance with prior research using the affective priming paradigm to assess food likes and dislikes (Lamote et al., 2004; Roefs et al., in press) in which similar results were found. However, unexpectedly both the obese group and the lean control group in Experiment 2 did not base their evaluation of the foods on the palatability, a finding that may seem difficult to reconcile with the findings of Experiment 1. More specifically, in Experiment 2, both groups of participants showed a preference for low-fat palatable foods over high-fat palatable foods. This suggests that their responses were controlled by health and weight concerns.

Notably, the findings of Experiment 2 resemble other prior research in our laboratory (Roefs & Jansen, 2002) with a different indirect measure, the Implicit Association Test (IAT) (Greenwald, McGhee, & Schwartz, 1998). Importantly, fat content was very salient in the IAT study, because food stimuli had to be categorized as either high-fat or low-fat. In this IAT study, both an obese group and a normal weight control group preferred low-fat foods over high-fat foods, and this effect was most pronounced for the obese group. Thus, health and weight concerns instead of palatability probably controlled the responses in this IAT experiment. In the current experiments - using the affective priming paradigm - participants were not required to classify foods as either high-fat or low-fat, thereby avoiding a

focus on the fat content. Probably, participants spontaneously classified the foods as being high-fat vs. low-fat, instead of being palatable vs. unpalatable. As Olson and Fazio (2003) pointed out, correspondence between the IAT and the affective priming paradigm can only be expected when participants categorize the stimuli in an affective priming task according to the same feature (e.g., fat content) as in an IAT.

Why then would both an obese group and a normal weight control group (Experiment 2) 'spontaneously' base their evaluations of the food on fat content instead of palatability? Admittedly health and weight concerns are strong for obese people, but in the study by Roefs et al. (in press), a group of restrained eaters - who are concerned about weight - based their evaluation of foods on palatability as well, and displayed the same pattern of results as a control group of unrestrained eaters - a liking of palatable foods over unpalatable foods. So, the current findings of Experiment 2 stand in sharp contrast with prior findings with the affective priming paradigm (Lamote et al., 2004; Roefs et al., in press).

A possible explanation may be found in the average speed of responding (see Hermans, Smeesters, De Houwer, & Eelen, 2002). Notably, participants in the current experiments were relatively slow in comparison with prior research (Lamote et al., 2004; Roefs et al., in press). In Experiment 2, this was most pronounced for the obese group. As Hermans et al. (2001) showed, the priming effect is only present when the SOA is fairly short (150 ms is optimal). Probably the automatic effect of the prime on the target dissipates at a longer SOA, because too much time for more controlled processing is available. Following the same line of reasoning, slower responding might cause the priming effect to disappear as well. Moreover, this slower responding may leave just enough time to realize the health or weight-related negative aspects of high-fat foods, resulting in a priming effect based on fat content - a negative association with high-fat foods. In other words, it could be that this understanding takes a little longer than an evaluation based on taste, and thus dominates the somewhat slower response. Interestingly, the AN group in Experiment 1 was also slower than the control group, and their average speed of responding was similar to the obese group. This slowness in responding in the AN group might have contributed to the absence of a palatability priming effect in that group. Note that the absence of a palatability priming effect was not replaced by a fat content priming effect in the AN group. Exactly why the AN group and the obese group were relatively slow in the current experiments is unclear however. These groups might be slower in general, or they might have been slowed down by the presentation of the food words because food is a source of worries for them (compare the emotional Stroop effect; Williams, Mathews, & MacLeod, 1996).

However, the average speed of responding cannot be the only explanation for the absence of a palatability priming effect in Experiment 2, because the speeds of responding in the control groups of Experiment 1 and 2 were about equal, whereas their priming effects were very different. For the control groups, the priming effect in Experiment 1 was based on palatability, whereas it was based on fat content in Experiment 2. Possibly the context in which Experiment 2 took place influenced the results. All participants in Experiment 2 were tested in a room in a local hospital, an environment which obviously emphasizes health. As Blair (2002) reviews, very subtle context manipulations can influence the outcome of indirect measures. So, the fact that Experiment 2 took place in a hospital may explain the current finding of Experiment 2 that participants focused on the healthiness of the palatable foods. Importantly, Experiment 1 took place in a more neutral environment, a test room in a university building.

Interestingly, the AN group was the only group that did not base their evaluation of the

foods on palatability when tested in a neutral environment, whereas the control group in Experiment 1, and the participants in prior studies (Lamote et al., 2004; Roefs et al., in press) did - all tested in a neutral environment. It would be interesting to see how obese people would respond in a more neutral environment, or possibly an environment that emphasizes the palatability of the foods. This latter manipulation of emphasizing palatability would also be interesting for an AN group, to see if the situation can make them consider foods as (un)palatable again. As Mitchell, Nosek, and Banaji (2003, p. 467) put it, "automatic attitudes are defined within the context established by the situation." Mitchell et al. consider attitudes as online reconstructions, not as fixed entities that are simply retrieved from memory. As these authors also suggest, their and similar findings (see Blair 2002 for a review) cast doubt on the idea of the existence of a single true attitude. In the case of attitudes toward foods, it certainly appears that how people evaluate foods is not simply controlled by the palatability of the foods or the specific characteristics of the participants. It seems to be an interaction between participant characteristics, stimuli characteristics, and the specific context.

Appendix: stimuli

Primes

High-fat palatable foods: chocola (chocolate), chips (chips), friet (fries), croissant (croissant), pizza (pizza), roomijs (ice cream)

High-fat unpalatable foods: haring (herring), speklap (slice of bacon), pate (pate), boter (butter), pindakaas (peanutbutter), walnoten (walnuts)

Low-fat palatable foods: aardbeien (strawberries), druiven (grapes), meloen (melon), kip (chicken), popcorn (popcorn), drop (liquorice)

Low-fat unpalatable foods: spruiten (Brussels sprouts), witlof (chicory), zuurkool (sauerkraut), andijvie (endive), radijs (radish), kabeljauw (cod)

Targets

Positive targets: vrede (peace), trouw (loyalty), zomer (summer), knuffel (hug), romantiek (romance), zonneschijn (sunshine), humor (humour), lente (spring), geschenk (gift), verrassing (surprise), cadeau (gift), baby (baby), feest (party), schoonheid (beauty), geboorte (birth), bruid (bride), bloesem (blossom), verjaardag (birthday), regenboog (rainbow), vlinder (butterfly), wens (wish), hemel (heaven), boeket (bouquet), melodie (melody)

Negative targets: oorlog (war), haat (hatred), ongeluk (accident), drugs (drugs), werkloosheid (unemployment), ongeval (accident), pijn (pain), dood (dead), scheiding (divorce), puist (pimple), zorgen (worries), roddel (gossip), belediging (insult), verdriet (grief), afval (garbage), schade (damage), angst (fear), schuld (guilt), vrees (fear), examens (exams), gebrek (defect), paniek (panic), vuilnis (garbage), mug (mosquito)

6

THE EFFECT OF INFORMATION ABOUT FAT CONTENT ON FOOD CONSUMPTION IN OVERWEIGHT / OBESE AND LEAN PEOPLE

This study investigated how fat content labels (high-fat vs. low-fat) influence milkshake consumption in obese/overweight people (n = 23), as compared to lean people (n = 21). Participants 'tasted' two isocaloric milkshakes in a staged taste test on two occasions. On one occasion the milkshakes were labeled high-fat, whereas on the other occasion they were labeled low-fat. The label-effect was in the expected direction of less (estimated future) consumption in the high-fat label condition, but was not significant for the current consumption and not different between groups. Unexpectedly, order (label high-fat first vs. label low-fat first) had a large effect on consumption.

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High-fat foods are especially 'threatening' for your figure because these high-fat foods contain more than twice as much energy than other macronutrients (fat: 9 kcal/g, carbohydrates and proteins: 4 kcal/g). Given that health aspects and weight concerns are important factors in determining food choice (Wardle, 1993), knowing that a food is high-fat may inhibit consumption. In fact, several studies have attempted to measure the effect of information about the fat content of the food on consumption. In general, these studies (Caputo & Mattes, 1993; Shide & Rolls, 1995; Wardle & Solomons, 1994) suggest that people adjust their consumption to the expected fat content in that they consume less when they think the food or preload is high-fat.

Moreover, in several studies the effect of information about fat content on palatability and health ratings was considered. Most studies found a positive effect of a high-fat label on palatability ratings (Kähkönen & Tuorila, 1998; Tuorila, Cardello, & Lesher, 1994; Tuorila, Kramer, & Engell, 2001; Wardle & Solomons, 1994; Westcombe & Wardle, 1997) but some of them found lowered palatability ratings for a high-fat label (Bowen, Green, Vizenor, Kreuter, & Rolls, 2003; Bowen, Tomoyasu, Anderson, Carney, & Kristal, 1992; Eiser, Eiser, Patterson, & Harding, 1984). This latter effect might be due to socially desirable answering tendencies, in that it could be seen as socially desirable in this society to report a dislike of high-fat foods. Several studies showed that foods labeled 'high-fat' were also considered as less healthy (Eiser et al., 1984; Engell, Bordi, Borja, Lambert, & Rolls, 1998).

This effect of a reduced consumption and lower palatability ratings caused by labeling the foods as high-fat, might be especially pronounced for overweight or obese people. Admittedly, they may specifically like the taste of high-fat foods (Drewnowski, Kurth, Holden-Wiltse, & Saari, 1992; Mela & Sacchetti, 1991; Rissanen et al., 2002), but they also often score high on restraint (Fairburn & Cooper, 1993). In other words, they are often concerned with their body, weight, and food, and have often undertaken at least several diet attempts. It is likely that they have tried to avoid high-fat foods in these diets. Moreover, a study by Roefs and Jansen (2002) showed that obese and normal weight participants had negative associations with high-fat foods, which were most pronounced for the obese group.

In the current study we will examine if these stronger negative associations with high-fat foods and higher restraint scores will translate to a stronger effect of information about fat content on consumption and palatability ratings of milkshakes in a staged taste-test. It is hypothesized that participants will consume less of the milkshakes labeled high-fat than of the milkshakes labeled low-fat, and that this effect will be stronger for the overweight / obese group. For palatability ratings it is hypothesized that the label high-fat will influence the palatability ratings more negatively for the overweight/obese group than for the lean control group.

Method

Participants

Participants were 23 overweight/obese (BMI: $M = 32.6$, $SD = 5.4$, *Range* = 25.9 - 47.9) and 21 lean (BMI: $M = 21.3$, $SD = 1.8$, *Range* = 18.4 - 24.7) women. BMI refers to body mass index, which is simply the ratio of weight to squared height (kg/m^2). This difference in BMI was statistically significant, $t(26.95) = 9.46$, $p < .001$. Note that the balance we used could weigh people up to a weight of 150 kg. Because one participant was heavier than 150 kg, we could not determine her exact weight, and we used '150 kg' for calculating her BMI.

One other participant did not want to be weighed, and we based her BMI on self-reported weight. Participants did not differ significantly in age, $t(42) < 1$ (overweight/obese: $M = 34.0$, $SD = 9.0$; lean: $M = 33.9$, $SD = 8.5$). The overweight/obese group ($M = 15.5$, $SD = 3.8$) scored significantly higher on restraint - evidence of dieting and concern about weight - than the lean control group ($M = 9.0$, $SD = 4.9$), as measured by the Restraint Scale, $t(42) = 4.92$, $p < .001$ (Herman & Polivy, 1980). The overweight/obese group (Global score: $M = 1.7$, $SD = 0.8$) also scored significantly higher than the lean control group (Global score: $M = 0.8$, $SD = 0.6$) on the presence and severity of specific eating pathology as measured by the Eating Disorder Examination - Questionnaire, $t(1, 42) = 4.67$, $p < .001$ (EDE-Q , Fairburn & Beglin, 1994).

Eight additional participants - not included in the groups described above - were tested in this experiment, but were excluded from analyses because they realized the real purpose of the study in the manipulation check ($n = 5$), or because they took medication for the thyroid gland ($n = 1$), or because they did not show for their second session ($n = 2$).

Procedure

Two isocaloric (400 kcal. each) strawberry flavored milkshakes (400 grams each) were prepared each morning. Participants came to the laboratory twice, and these two milkshakes were presented in each session. Prior to their first session participants signed an informed consent form. At the start of both sessions, instructions appeared on a computer monitor. Participants were led to believe that the food industry wanted to test these new dairy products, and that they were going to taste these new products. Depending on condition, the participant was either told that the two dairy products were extra creamy (40% fat) or low-fat (3% fat).

Two cans of milkshake (400 g each) in a closed opaque box with a straw for each milkshake, and a small glass of water (appr. 100 ml) were presented. By putting the milkshakes in an opaque box, the participant could not see what the milkshakes looked like, or how much she had consumed of each milkshake. Participants were told that their task was to judge the milkshakes on several dimensions (e.g., sweetness, palatability) by answering the questions that would appear on the monitor (all 9-point scales). Moreover, the Food Action Rating Scale (FACT) (Aaron, Mela, & Evans, 1994; Schutz, 1965) was part of the staged taste test. This scale measured intended consumption in the future. This 9-point scale ranges from '1: I would only consume this drink if I were forced to' to '9: I would like to consume this drink on every possible occasion.' They were also told that they should try to taste the milkshake before answering each question. Each participant was given exactly 15 minutes for the 'taste test', after which the experimenter returned.

At the end of the first session, participants were just reminded of their next appointment. After finishing the second session, a manipulation check was performed and subsequently participants filled out the Restraint Scale (Herman & Polivy, 1980) and the EDE-Q (Fairburn & Beglin, 1994). At the end of the taste test of each session (15 min), the experimenter determined the amount of milkshake that was consumed during the taste test. All testing took place in the afternoon; sessions started between 1.00 pm and 4.00 pm. Participants were tested twice within the same week at the same point in time. All participants were asked not to consume any foods within two hours prior to the taste test. Note that two participants (one obese, and one normal weight control) did consume food within two hours prior to the taste test, however the amount was equal on the two test days. One other participant (obese) consumed two small cookies prior to her first taste-session

only (instruction: high-fat). These three participants did not consume foods within one hour prior to the taste test.

Design

All participants took part in two test sessions. In one session they were told that the two milkshakes were extra creamy (40% fat) and in the other session they were told that the two milkshakes were low-fat (3% fat). All data were analyzed in a 2 (label: label high-fat vs. label low-fat) × 2 (order: session 1 label high-fat vs. session 1 label low-fat) × 2 (group: overweight/obese vs. lean) ANOVA, with repeated measures on the first factor. Order of labels about fat content was counterbalanced over participants. The main dependent variables were the amount of milkshake consumed during the taste test, the intention to consume the milkshakes in the future, and the palatability rating.

Results

Consumption during the taste test

An instruction × order interaction, $F(1, 40) = 21.38$, $p < .001$ superseded a non-significant main effect of instruction, $F(1, 40) = 2.75$, $p = .11$. The results did not differ between the two groups, all $Fs(1, 40) < 1.27$. Separate analyses were conducted for each order (label high-fat first vs. label low-fat first). When the milkshakes were labeled high-fat in the first session, participants consumed significantly more of the milkshake labeled low-fat than of the milkshake labeled high-fat, $F(1, 21) = 19.62$, $p < .001$. When the milkshakes were labeled low-fat in the first session, participants consumed significantly more of the milkshake labeled high-fat than of the milkshake labeled low-fat, $F(1, 19) = 4.47$, $p < .05$. See Figure 6.1 for relevant means and standard errors.

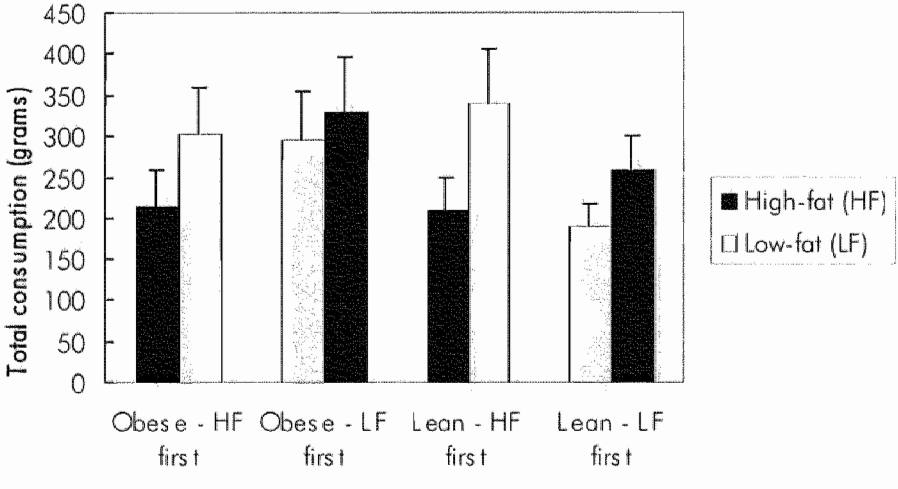

Figure 6.1 Total milkshake consumption (g) as a function of fat-content label, separately for each group (overweight/obese vs. lean) and each order (high-fat label first vs. low-fat label first). Error bars represent one standard error.

Intention to consume the milkshakes (FACT scale)

On average, all participants reported a lower intended future consumption for the milkshake labeled high-fat (overweight/obese: $M = 4.2$, $SD = 1.2$; lean: $M = 3.9$, $SD = 1.7$) than for the milkshakes labeled low-fat (overweight/obese: $M = 4.5$, $SD = 1.5$; lean: $M = 4.6$, $SD = 1.5$), $F(1, 40) = 9.85$, $p < .01$. This effect was not different for the two groups, $F(1, 40) = 1.66$, $p = .21$. Note that the reported means are pooled over the factor 'order'.

Palatability ratings.

The label did not significantly influence the palatability ratings, $F(1, 40) = 1.89$, $p < .18$, and the effects were the same in both groups, all $Fs(1, 40) < 1.1$ (label HF overweight/obese: $M = 5.6$, $SD = 1.5$; label LF overweight/obese: $M = 5.8$, $SD = 1.3$; label HF lean: $M = 5.7$, $SD = 1.3$; label LF lean: $M = 5.8$, $SD = 1.5$). Note that the reported means are pooled over the factor 'order'.

Discussion

Consumption was hypothesized to be influenced by fat content labels, in that participants were expected to consume less when the milkshakes were labeled high-fat than when they were labeled low-fat. Moreover it was expected that this effect would be especially pronounced for the overweight/obese participants. This would suggest that overweight/obese people worry more about their fat intake, and try to monitor it. The label effect was in the hypothesized direction of less consumption with the high-fat label than with the low-fat label. However this effect was not significant and was not specific or stronger for the overweight/obese group, although power may have been a problem. These results are comparable to a study by Bowen et al. (2003), in which a similar (nonsignificant) decrease in consumption was found when foods were labeled as high-fat as compared to low-fat. Notably, Bowen et al. (1992), employing a similar methodology, found an opposite effect. Women consumed more of high-fat ice cream when it was labeled high-fat than when it was labeled low-fat. A possible explanation, put forward by Bowen et al. (1992), could be that this group of participants was not particularly weight-conscious, and that they based consumption on expectancies of good taste. Notably, energy intake was found to be higher after participants received a lunch or a preload labeled low-fat (Caputo & Mattes, 1993; Shide & Rolls, 1995). Furthermore, Wardle and Solomons (1994) found that participants ate a lower proportion of sandwiches labeled full-fat when they received information about cardiovascular diseases in comparison to a no information control group.

Unexpectedly, the order of the labels (label HF in first session vs. label LF in first session) - which was carefully counterbalanced - played an important role. For the participants that consumed the milkshake labeled high-fat first, consumption on this first occasion was likely inhibited by both the high-fat label and the fact that the situation was novel to them (see Overduin & Jansen, 1997). The label high-fat may have inhibited consumption by both fear of fatness (restraint) and by expectations of greater satiation. The situation was novel in the sense that they were asked to consume novel dairy products in a novel environment (laboratory). In their second session (milkshakes labeled low-fat), consumption was likely promoted by both the low-fat label and the relative familiarity of the testing situation. The low-fat label may have promoted consumption by both a cognitive disinhibition (low-fat foods are allowed) and a lowered satiation expectation, in that they may have expected that the milkshakes labeled low-fat would be less satiating than the milkshakes labeled

high-fat in the previous session.

For the group of participants that received the milkshakes labeled low-fat in the first session, the effects of novelty and label likely operated in opposite directions. In their first session, the label low-fat likely promoted consumption, whereas the novel test situation likely inhibited consumption. In their second session, the label high-fat may have inhibited consumption, whereas the relative familiarity of the testing situation may have promoted consumption, leading to a higher consumption in the second session (milkshakes labeled high-fat). This significantly higher consumption in the second session suggests that the effects of novelty were a stronger determinant of consumption than the effects of fat content label.

By adding the Food Action Rating Scale (FACT; Aaron et al., 1994; Schutz, 1965) to our staged taste test, the intended future consumption was measured. The effects for the FACT score were consistent with our hypothesis of less consumption of milkshakes labeled high-fat than of milkshakes labeled low-fat. However, these effects were not different for the overweight/obese as compared to the lean control group. For the palatability ratings, no effects of either label or group were found. Ratings were similar across groups and labels.

In sum, the current results suggest that effects of novelty and fat content label effects may operate together in determining consumption. The effects of novelty may even be stronger than effects of fat content labels in this kind of experiments. For the expected future consumption (FACT) only the fat content label played a role, in that lower ratings were given to the milkshakes labeled high-fat, independent of familiarity with the lab situation.

THE ENVIRONMENT DETERMINES WHETHER CHOCOLATE IS PALATABLE OR UNHEALTHY

7

The purpose of the current experiments was to investigate whether relatively automatic evaluations of food differ between situations and between obese and lean controls. In Experiment 1, we either focused participants (33 obese and 26 lean controls) on the palatability of food (*restaurant condition*) or on the healthiness of food (health condition), prior to the affective priming task. Independent of weight-status, relatively automatic evaluations of food were indeed based on palatability in the restaurant condition, whereas they were based on health in the health condition. So, the current focus of attention can shape the way we evaluate foods relatively automatically. In Experiment 2 we induced a state of craving in our participants (27 obese and 29 lean controls). Obese people showed a stronger palatability priming effect with increasing levels of initial craving, which suggest that a craving induction may work better for obese people than for lean controls. Unexpectedly, the palatability priming effect was more positive for low-fat foods than for high-fat foods, which may be explained by the health-emphasizing environment in which the study took place, a hospital. In sum, our environment with its abundance of high-fat palatable foods may have a considerable impact on the way we evaluate foods.

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People - and especially obese people - are known to underreport their intake of (high-fat) foods (Heitmann, Lissner, & Osler, 2000), and may be reluctant as well to admit a liking for high-fat foods. The intake of these high-fat foods seems an important factor contributing to the global obesity epidemic (e.g., Lissner & Heitman, 1995). This heightened intake of high-fat foods in obese people may be caused by an increased preference for this type of food (Rissanen et al., 2002). On the other hand, our society is sometimes called an "obesifying society" (Wadden, Brownell, & Foster, 2002). Everywhere around us we are reminded of high-fat palatable foods. Would this preference for high-fat foods reflect a person characteristic (i.e., weight), or would it depend on the situation? In the current experiments, we investigated these possibilities using so-called indirect measures.

Recently, there has been an enormous increase in the application of indirect measures, such as the affective priming paradigm (Fazio, Sanbonmatus, Powell, & Kardes, 1986) and the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), in clinical psychology (e.g., de Jong, Pasman, Kindt, & van den Hout, 2001; Roefs & Jansen, 2002; Teachman, Gregg, & Woody, 2001). These indirect measures are designed to tap automatic associations or attitudes. One of the main reasons for indirect measures' popularity is the assumption that these automatic processes are inflexible - stable across situations - and cannot be influenced by someone's goals or intentions. This assumption has contributed to the idea that attitudes or evaluations assessed by these indirect measures may represent someone's true attitude or evaluation (Blair, 2002). Fazio, Jackson, Dunton, and Williams (1995) even called the affective priming paradigm a 'bona fide pipeline' for attitude or evaluation measurement. This certainly would be an interesting way of assessing food preferences.

However, Banaji (2001) pointed out that both indirect and direct measures (e.g., self-reports) can be valid indicators of attitudes or associations, "each of a different form of the same attitude object and within the same mind" (p. 136). Also, Fazio and Olson (2003) now share this point of view, and according to their MODE model (Fazio & Towles-Schwen, 1999), which type of measure (indirect vs. direct) is predictive of behavior depends on someone's motivation and opportunity to engage in more controlled processing. So, though there may not be such thing as a 'real attitude', the study of automatic evaluations is still interesting in that it can be very informative to assess what someone's relatively spontaneous associations are, because they guide behavior when there is no opportunity or motivation for more controlled processing. This also holds true for research into food preferences of obese people. When these food preferences are assessed in a paradigm in which not much time for controlled processing is left, participants give their "first" impression of that food. This early association is plausibly based on taste, because taste is considered the most important characteristic of food (Eertmans, Baeyens, & Van den Bergh, 2001), and thus likely to be the basis of categorization (Smith, Fazio, & Cejka, 1996). If it was shown that obese people are characterized by a stronger positive association with (high-fat) palatable food, it would follow that they would always have to suppress this initial response to avoid eating too much (high-fat) food.

It is important to note, following Fazio and Olson (2003), that an evaluation or attitude assessed by an indirect measure is not necessarily an unconscious one. Participants may not be aware of what the task is assessing, because the measurement is indirect, but they may very well be aware of their attitude or evaluation. Because the term 'implicit' seems to carry the notion of 'unconscious', we follow Fazio and Olson (2003; see e.g., MacLeod, 1989) in using the terms 'indirect' and 'direct', instead of 'implicit' and 'explicit'. Responses

are assumed to be relatively automatic in this kind of task, because stimuli are presented in quick succession and participants are urged to respond as quickly as possible, leaving insufficient time for controlled processing. In other words, people may not be able to control the impact of their attitude on performance on the indirect task, and may not have that intention (Blair, 2002). Thus, the term automatic is not equivalent to the term unconscious, but rather means that indirect measures leave insufficient time for participants to strategically control their response.

Prior research in our laboratory used both the IAT (Greenwald et al., 1998) and the affective priming paradigm (Fazio et al., 1986) to study relatively automatic associations with food (see also Lamote, Hermans, Baeyens, & Eelen, 2004) in various groups of participants, such as obese people (Roefs & Jansen, 2002; Roefs et al., 2004), restrained eaters (i.e., people who intend to control their food intake, but regularly fail and indulge in the foods they crave; Roefs, Herman, MacLeod, Smulders, & Jansen, in press), and anorexia nervosa patients (Roefs et al., 2004). Based on prior research that suggest that obese people have a preference for high-fat foods (e.g., Drewnowski, Kurth, Holden-Wiltse, & Saari, 1992; Rissanen et al., 2002) and consume more of these foods (Lissner & Heitmann, 1995), we hypothesized that they would have stronger positive associations with (high-fat) palatable foods.

However, both studies with obese participants in our laboratory suggested that obese people and normal weight people alike have more negative associations with high-fat foods than with low-fat foods. Explanations for these relatively negative associations may be found in (subtle) context effects. It is common knowledge that attitudes assessed by direct measures (e.g., questionnaires) can be influenced by context (Schwarz, 1999), but as Blair (2002) reviews, attitudes or evaluations assessed by indirect measures can also be influenced by the current context and the focus of attention. This apparent malleability of automatic attitudes or evaluations has important consequences. It certainly suggests that there might not be one uniform and stable automatic association with a certain attitude object that influences responding when there is no motivation or opportunity to engage in more controlled processing. So, these automatic associations seem neither to reflect a true attitude nor do they seem to be stable across situations. A rather large body of research now suggests that automatic associations are more flexible and situation-specific than was assumed before (Blair, 2002). So, it may be more accurate to view attitudes or evaluations not as static entities that can be retrieved from memory, but as online reconstructions that are influenced by the immediate situation and current focus of attention (Mitchell, Nosek, & Banaji, 2003).

To return to the role of context and focus of attention in our food studies, a first study in our laboratory comparing obese and normal weight controls (Roefs & Jansen, 2002) used the IAT (Greenwald et al., 1998). In this study, a relatively negative association with high-fat foods was found, which was most pronounced for the obese participants. In an IAT, participants are asked to categorize concept and attribute stimuli into predefined categories (in our study: 'high-fat' vs. 'low-fat' and 'positive' vs. 'negative'). Importantly, IAT effects have been shown to be strongly influenced by these category labels (De Houwer, 2001, 2003). So, the IAT at least partly reflects an attitude toward the category (e.g. 'high-fat foods'), instead of toward individual exemplars (e.g. 'chocolate'). It is perhaps unsurprising that people dislike the fact that chocolate is high-fat, even though they love the taste of chocolate. Similarly, research by Mitchell et al. (2003) showed that the basis of categorization - focus of attention - influences the automatic attitude dramatically. For example, their

results showed that participants had more positive associations with admired black athletes than with disliked white politicians when participants had to categorize stimuli by occupation, whereas participants had more negative associations with admired black athletes than with disliked white politicians when participants had to categorize stimuli by race. This suggests that people do not have one simple association with an attitude object, and that the association is dependent on the current focus of attention (occupation vs. race). In sum, in the study by Roefs and Jansen (2002) the fat content of the food - which was the basis of categorization - was a salient characteristic, which might have led to the negative associations with high-fat foods.

However, in a related study (Roefs et al., 2004), we used the affective priming paradigm (Fazio et al., 1986; see Method for a description of this paradigm), in which participants were not required to sort stimuli into predefined categories (e.g., high-fat vs. low-fat). In other words, participants' responses were not steered in a certain direction in this paradigm, but were activated upon presentation of the prime, and influenced responding to the target. Notably, also in this study we found evidence for more negative associations with high-fat palatable foods than with low-fat palatable foods for both obese and normal weight controls. This finding might be explained by a more subtle context effect, namely the environment in which this study took place: a local hospital. A hospital is an environment in which 'health' is obviously salient. As Lowery, Hardin, and Sinclair (2001) showed, even a rather subtle manipulation of context (cf. hospital environment) can considerably influence automatic evaluations or attitudes. In their studies on racial attitudes, they found less automatic prejudice when a black experimenter conducted the study than when a white experimenter conducted the study. This finding is remarkable, because of the common assumption that prejudice is automatically activated when a member of a prejudiced group is present.

In conclusion, an evaluation of food may not be the same in every situation and might depend on the current focus of attention. The palatability of a food is the most important characteristic of a food for most people (Eertmans et al., 2001). However the healthiness of a food certainly matters as well, maybe especially in our society, in which a slim figure is considered very important (Puhl & Brownell, 2003; Teachman & Brownell, 2001). So, foods are actually multiply categorizable items (Smith et al., 1996). A food can be categorized as palatable vs. unpalatable, or can be categorized as healthy vs. unhealthy (i.e. fattening). In both of our prior studies with obese people, healthiness of foods was - unintentionally - made salient, either by the basis of categorization (high-fat vs. low-fat) or by the environment (hospital). In the current studies we will - intentionally - manipulate the salience of taste and health aspects of food, and study how this affects priming effects. Moreover, in both experiments the influence of weight status (obese vs. lean control) on the priming effect will be studied.

EXPERIMENT 1

In Experiment 1 we attempted to manipulate participants' focus of attention, by either highlighting the palatability of food or highlighting the health aspects of food. In the first condition (restaurant condition) participants were asked to imagine they were a restaurant owner about to prepare a special gourmet dinner. In the second condition (health), participants were given information about healthy eating patterns, and a short assignment. The

manipulation was a between-subjects factor, and participants were randomly assigned to one of these conditions. These manipulations took place just before participants started the affective priming task, the indirect measure for assessing evaluations of food. We hypothesized that in the first condition (restaurant condition), a relatively automatic evaluation of food would be based on taste aspects, whereas we expected it to be based on health aspects in the second condition (health). More specifically, in the restaurant condition we expected participants to display a liking of palatable foods over unpalatable foods. Moreover, we expected a liking of high-fat foods over low-fat foods because high-fat foods are typically craved more frequently than low-fat foods (Hill & Heaton-Brown, 1994; Weingarten & Elston, 1991) and the items in the restaurant task were high-fat palatable foods. In the health condition, we expected participants to display a preference for low-fat foods over high-fat foods. A priori we did not have an expectation about the effect of palatability, because we did not know which type of food (palatable vs. unpalatable) would be considered as healthier. Note that this is checked in a direct health rating task.

Moreover, we were interested in the effects of weight-status (obese vs. lean control). Based on prior research that suggests that obese people are more sensitive to the palatability of food (for a review see Pliner, Herman, & Polivy, 1990) and that they have a specific preference for high-fat foods (e.g., Drewnowski et al., 1992; Gerding & Weinstein, 1992; Rissanen et al., 2002), we hypothesized that the obese participants would show a specific preference for high-fat palatable foods.

Method

Participants

Participants were 33 obese women (BMI[1] > 30) and 26 female lean unrestrained eaters (BMI: 18.5 - 25). Restraint-status was determined by the Restraint Scale (Herman & Polivy, 1980). A participant qualified as an unrestrained eater when she scored 14 or below on this scale. Participants were recruited by advertisements in a Dutch women's magazine and in local newspapers. See Table 7.1 for participant characteristics.

Table 7.1 Experiment 1: Participant characteristics, means with standard deviation in parentheses

	Obese	Lean	*t*	*df*	*p*
Age	41.7 (6.9)	41.8 (8.1)	0.05	57	.96
BMI	38.1 (4.7)	22.2 (1.7)	18.0	41.7[1]	< .001
Restraint Scale	19.3 (5.3)	8.5 (2.3)	10.4	44.1[1,2]	< .001

[1]Equality of variances could not be assumed

[2]One of the obese participants did not fill out the Restraint Scale

[1]BMI = Body Mass Index = weight / height[2]

Several additional participants - not included in the groups described above - were tested, but were excluded from analyses based on beforehand defined exclusion criteria. Three participants (1 obese and 2 lean controls) were excluded because of a high percentage (> $M + 3\ SD$) of errors or responses that were either too fast or too slow, on the affective priming task. Eleven participants were excluded because they did not meet the criteria for one of the two groups (BMI and Restraint Scale total score).

Overview affective priming paradigm

In this paradigm (Fazio et al., 1986; Klauer & Musch, 2003) two stimuli are presented in quick succession, a prime followed by a target. No response is required to the prime, which is simply displayed and replaced by the target. Participants have to respond to the target by evaluating it as being positive or negative. The dependent variable is the positive/negative key-press latency in response to the target.

The focus of the priming paradigm is on the extent to which the presentation of the prime influences the response to the target. Typically (e.g., Bargh, Chaiken, Govender, & Pratto, 1992; Fazio et al., 1986; Hermans, De Houwer, & Eelen, 1994, 2001), affectively congruent prime-target pairs (e.g., 'love' - 'happy') lead to shorter response latencies to the target word than do affectively incongruent prime-target pairs (e.g., 'love' -'awful'). The critical idea is that the pattern of response latencies as a function of affect match between prime and target indicates how people evaluate the prime on a fairly automatic level. Applied to the palatability of food, if people respond faster on congruent trials ('palatable - positive' and 'unpalatable - negative') than on incongruent trials ('palatable - negative' and 'unpalatable - positive'), it can be inferred that they like palatable foods more than unpalatable foods.

Stimulus selection and timing of trials in the priming task

Primes. Six high-fat palatable foods (e.g., chocolate), six low-fat palatable foods (e.g., strawberries), six high-fat unpalatable foods (e.g., bacon), and six low-fat unpalatable foods (e.g., radish) served as primes (see Appendix). The four groups of primes did not differ significantly in word length, $F(3, 20) < 1$. Palatability was determined on the basis of a pilot study, in which it was tested which foods are generally liked and disliked by female university students ($n = 64$).

In this pilot study, participants were given two separate sheets of paper. On one sheet, a list of 28 high-fat foods was printed; on the other sheet, a list of 33 low-fat foods was printed. These foods were mainly selected by using a food composition table (NEVO, 1993). High-fat and low-fat foods were on separate lists because participants might otherwise have been 'tempted' to give low-fat foods a better rank, which may be seen as socially desirable. They were asked to choose from each list the eight foods that they liked most, and the 8 foods that they disliked most. Then they were asked to rank the eight foods that they (dis)liked the most from each list from 1 ((dis)like the most) to 8 ((dis)like the least). Stimulus selection for the current experiment was based on the mean ranking of a food, weighted by the number of participants who put that food in their selection of (dis)liked foods. In this way, we selected 6 high-fat liked, 6 high-fat disliked, 6 low-fat liked, and 6 low-fat disliked foods (see Appendix).

Targets. Twenty-four general positive (e.g., 'gift') and 24 general negative (e.g., 'pain') words served as targets (see Appendix), and were selected according to word norms by Hermans and De Houwer (1994), who had participants rate a large number of words on 7-

point scales (1 - 7) for pleasantness ('very negative - very positive') and familiarity ('familiar - unfamiliar'). The two groups of stimuli obviously differed significantly in pleasantness (negative: $M = 2.0$, $SD = 0.31$ vs. positive: $M = 6.0$, $SD = 0.29$), $t(46) = 46.25$, $p < .001$. There were no significant differences between the two groups of stimuli in affective extremity (negative: $M = 2.0$, $SD = 0.31$ vs. positive: $M = 2.0$, $SD = 0.29$), $t(46) < 1$, or word length (negative: $M = 6.2$, $SD = 2.02$ vs. positive: $M = 6.79$, $SD = 2.13$), $t(46) < 1$. However, a small significant difference in familiarity ratings was found (negative: $M = 4.8$, $SD = 0.45$ vs. positive: $M = 5.1$, $SD = 0.48$), $t(46) = 2.38$, $p < .05$. Primes and targets were presented in black lower-case letters (6 mm high) against a light background on a computer monitor (see Appendix).

Randomization of stimuli. Each participant was given 144 trials, split up into 3 blocks of 48 each. Each food-stimulus (prime) was paired once with a positive and once with a negative target in each block. All primes had been presented once (with either a positive or a negative target) before any prime was presented for the second time in each block. For each participant, and for each of the three blocks, it was determined randomly which half of each of the types of primes (high-fat palatable, high-fat unpalatable, low-fat palatable, low-fat unpalatable) would be paired first with a positive/negative target. Primes and targets were both randomly selected (unique for each participant) from their respective sets without replacement.

Trial timing. The timing of trials was modeled after the procedure of Hermans et al. (2001). All stimuli were presented in the center of the monitor. Each trial started with a a fixation cross (700 ms). Then the prime was presented for 150 ms. After a 150 ms stimulus onset asynchrony (SOA) - the time that elapses between the onset of the prime and the onset of the target - the target was presented on the monitor. The target remained on the monitor until a response was given or for 2500 ms if no response was given. If an error was made or a response was either too slow or too fast, or if no response at all was given, a warning appeared on the screen for 300 ms. The inter-trial interval was 2500 ms.

Materials

Manipulations. The 'restaurant task' was intended to focus participants on the (un) palatability of foods. In this task participants were asked to imagine that they were a chef in a fancy restaurant, and that they had to prepare a special dinner for a wedding. They were presented with 14 sets of 2 menu-items and they were asked to indicate each time which menu-item they liked best. All menu-items were high-fat palatable foods.

The 'health task' was intended to focus participants on the health aspects of food. Participants were given an information sheet about healthy eating habits. This information emphasized that high-fat foods are fattening and unhealthy when consumed too much. Then they were presented with 14 sets of 2 menu-items. Each set consisted of a clearly healthy and a clearly unhealthy (high-fat) menu-item. Participants were asked to indicate which menu-item they thought was the healthiest.

Direct rating task of foods. Whereas palatability was based on a pilot study, health ratings for the four types of food were asked in a brief questionnaire. The 24 foods that were used as primes were presented in a random order (identical for all participants) on a paper-and-pencil rating task. Participants were asked to rate the foods on health (7-point scale: 1: very unhealthy - 7: very healthy).

Restraint Scale. The Restraint Scale measures "the extent to which participants show evidence of dieting and concern about their weight" (Herman & Polivy, 1980, p. 212). The

minimum score on this scale is 0 and the maximum score is 35.

Procedure

Participants were tested in session-groups of up to 13 people, in research cubicles. All testing took place between 1.30 and 2.30 pm. The experimenter was present during the entire procedure. First, they were given instructions on how to perform the priming task. They were instructed to read each word that appeared first on the monitor silently, and then to decide whether each second word was positive or negative, pressing the corresponding key on the key box (key assignment was counterbalanced across participants). They were told to respond as quickly as possible but to avoid making too many mistakes. Participants were then presented with 16 practice trials using stimulus materials different from those on the experimental trials. Similar to Zack, Toneatto, and MacLeod (1999), they were given a free recall test for the primes immediately after the practice trials, writing down as many words as they could remember that appeared as a first word (prime) on the computer task that they had just performed. This task was included to ensure that participants paid attention to both primes and targets by raising the possibility that participants might be asked to perform such a free recall task later in the procedure. After this memory test, 16 of the obese participants and 14 of the lean control participants received the 'restaurant task'. Seventeen of the obese and 12 of the lean control participants received the 'health task' (tasks were randomly assigned to participants within each session group).

Participants were given a brief repetition of the instruction for the priming task, and were then ready to begin the actual priming task, which was made up of three blocks, with short breaks in between. After the final block of the priming task, the participants were again given a free recall test for the primes. Administration of the Restraint Scale (Herman & Polivy, 1980), and the measurement of weight and height took place after participation in another unrelated experiment on the same day.

Apparatus

The experiment was carried out on Dell Optiplex GX260 computers with Pentium IV processors, connected to Dell M992 monitors. Key responses were registered by external response devices with better than one millisecond accuracy. The software controlling the experiment was programmed in ERTS (Experimental Run Time System, Beringer, 1996).

Design and analysis procedure of the affective priming paradigm

Data were analyzed using a 2 (target affect: positive vs. negative) × 2 (fat-content prime: high-fat vs. low-fat) × 2 (palatability of prime: palatable vs. unpalatable) × 2 (group: obese vs. control) × 2 (manipulation: restaurant vs. health) analysis of variance (ANOVA). The factors target affect, fat-content prime, and palatability of prime were within-subjects factors, whereas group and manipulation were between-subjects factors. An interaction between prime and target indicates that there is a priming effect (i.e., that the presentation of the prime influences the speed and accuracy of responding to the target). Note that there can be an interaction between prime palatability and target affect, suggesting an automatic evaluation of taste, and an interaction between prime fat content and target affect, suggesting an automatic evaluation of fat-content. Partial eta squared (η^2) is reported as a measure of effect size for all analyses.

Results and Discussion

Direct rating task food.

First, the health ratings for the four types of food primes were analyzed to check how these four types of stimuli would be rated on health. Health ratings (1: very unhealthy to 7: very healthy) were analyzed in a 2 (palatability: palatable vs. unpalatable) × 2 (fat content: high-fat vs. low-fat) × 2 (group: obese vs. control) × 2 (manipulation: restaurant vs. health) ANOVA. The palatability factor is based on the pilot study.

Unsurprisingly, low-fat foods ($M = 5.8$, $SD = 0.4$) were judged as healthier than high-fat foods ($M = 3.1$, $SD = 0.7$), as was apparent from a main effect of fat content, $F(1, 55) = 908.98$, $p < .001$, $\eta^2 = .94$. Moreover, unpalatable foods ($M = 5.3$, $SD = 0.5$) were judged as healthier than palatable foods ($M = 3.6$, $SD = 0.5$), as was apparent from a main effect of palatability, $F(1, 55) = 774.78$, $p < .001$, $\eta^2 = .93$. Thus, when asked directly, participants considered low-fat foods as healthier than high-fat foods and unpalatable foods as healthier than palatable foods[2].

Analyses priming task[3]

The reported analyses are for the dependent variables response latency (speed) and percentage of errors (accuracy). Response latencies associated with responses that were either too fast (< 200 ms) or too slow (> 2000 ms) were discarded, a total of only 0.46% of all trials. Response latencies associated with error responses (6.5%) were also discarded. The assumption of equality of variances was checked per within-subjects contrast across the between-subjects groups with the Levene's Test of equality of error variances, and was not rejected. See Table 7.2 for all relevant statistics.

[2] The effect of fat content was qualified by some interactions, which were deemed irrelevant for the current purposes of checking how the four types of primes would be rated on healthiness. For the lean control group, the effect of fat content was slightly stronger in the 'health' condition than in the 'restaurant' condition, as evidenced by a fat content group manipulation interaction, $F(1, 55) = 4.60$, $p < .05$, $\eta^2 = .08$, which qualified a fat content × manipulation interaction, $F(1, 55) = 3.60$, $p = .06$, $\eta^2 = .06$, and a fat content × group interaction, $F(1, 55) = 4.74$, $p < .05$, $\eta^2 = .08$. The effect of fat content tended to be slightly larger for palatable foods than for unpalatable foods, $F(1, 55) = 3.35$, $p = .07$, $\eta^2 = .06$. Moreover, the effect of the factor palatability was a little stronger for the obese group than for the lean control-group, $F(1, 55) = 5.69$, $p < .05$, $\eta^2 = .09$.

[3] Analyses were also performed on the log-transformed latencies, by computing the natural logarithm of each mean RT per condition. This did not lead to different results or conclusions. Moreover, analyses were performed on the square-root transformed error percentages. Results of the overall error analyses were not affected. For the separate error analyses per manipulation ('restaurant' vs. 'health'), the p-value of the palatability priming effect in the restaurant condition went from $p = .02$ to $p = .07$, whereas the p-value of the palatability priming effect in the health condition went from $p = .08$ to $p = .13$.

Table 7.2 Experiment 1. All effects that are relevant for our hypotheses are reported in this table, and will be printed in bold when they are (marginally) significant. Significant, but for the hypothesis irrelevant effects, will also be reported (bottom six rows). Irrelevant insignificant effects (all *p*-values > .11) will not be reported.

Effect	Response latencies			Error percentages		
	$F(1,55)$	p	η^2	$F(1,55)$	p	η^2
target × prime-fat	0.05	.83	.001	0.004	.95	<.001
target × prime-fat × group	0.13	.72	.002	0.10	.75	.002
target × prime-fat × manip	**3.74**	**.06**	**.06**	0.43	.51	.01
within manip taste: target × prime-fat	2.23	.15	.07			
within manip health: target × prime-fat	1.54	.23	.05			
target × prime-fat × group × manip	0.17	.68	.003	0.47	.50	.01
target × prime-pal	0.85	.36	.02	0.14	.71	.003
target × prime-pal × group	0.44	.51	.01	0.37	.54	.01
target × prime-pal × manip	0.31	.58	.01	**9.32**	**.003**	**.15**
within manip taste: target × prime-pal				**6.52**	**.02**	**.19**
within manip health: target × prime-pal				**3.24**	**.08**	**.11**
target × prime-pal × group × manip	1.73	.19	.03	1.16	.29	.02
target × prime-fat × prime-pal (× group) (× manip)	<1	>.54	<.01	<1.42	>.24	<.03
target	19.14	<.001	.26	4.66	.04	.08
prime-fat × manip	5.69	.02	.09			
prime-fat × group × manip				2.82	<.10	.05
prime-pal	3.12	.08	.05			
prime-fat × prime-pal × group				3.22	.08	.06
group × manip				7.10	.01	.11

Note: target = target affect, prime-pal = prime palatability, prime-fat = prime fat-content, manip = manipulation

Fat content priming effect - response latencies. As can be seen in Figure 7.1A, the manipulation had the expected effect. The pattern of latencies in the 'restaurant condition' suggests that health concerns did not play a role in participants' early associations on the affective priming task, in that the means suggest a preference for high-fat foods over low-

fat foods. The pattern of latencies in the 'health condition' suggests that health aspects influenced responding in the priming task, in that the means suggest a preference for low-fat foods over high-fat foods. Consistent with our hypothesis, participants in the 'restaurant condition' displayed an opposite fat content priming effect as compared to participants in the 'health condition', as was apparent from the marginally significant target affect × prime fat content × manipulation interaction. Though the pattern of means was - as expected - in an opposite direction for each manipulation, the target affect × prime fat content interaction was not significant in a separate analysis for the 'restaurant condition' or for the 'health condition'. The factor group did not influence the results.

Fat content priming effect - error percentages. In the analysis on error percentages, no evidence was found for any priming effects. See Figure 7.1B for relevant means and standard errors.

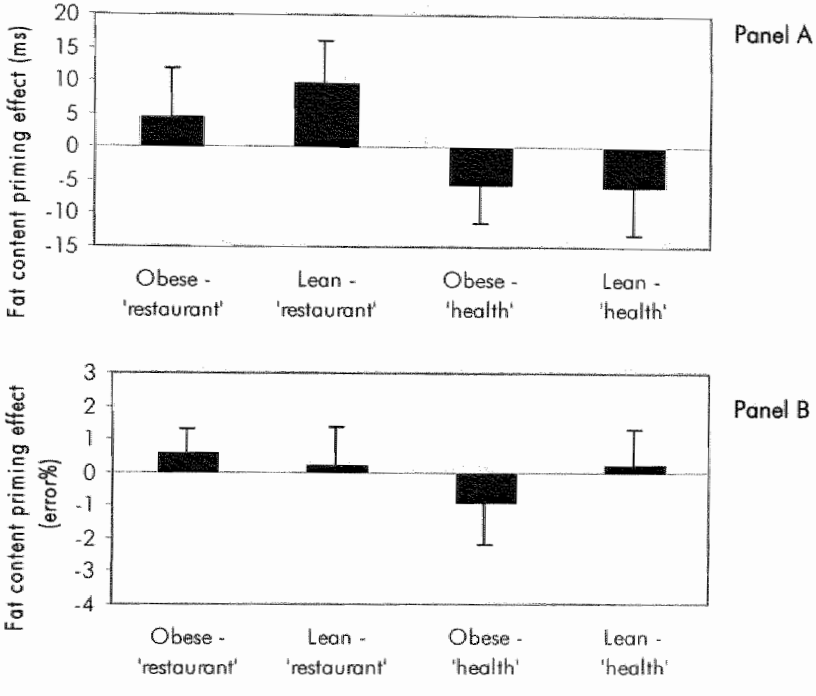


Figure 7.1 Experiment 1: The fat content priming effect as a function of participant group (obese vs. lean control) and manipulation (restaurant vs. health). The means are collapsed over the factor prime palatability. The fat content priming effect (RT and percentage of errors) for each participant is computed as: ((mean (high-fat -) + mean (low-fat+)) / 2) - ((mean (high-fat+) + mean (low-fat -)) / 2). In this formula, 'high-fat' or 'low-fat' indicates the fat content of the prime, whereas the plus or minus sign right behind it, indicates whether the target was positive or negative. A positive score indicates a preference for high-fat foods over low-fat foods, and a negative score indicates a preference for low-fat foods over high-fat foods. Error bars represent one standard error. Panel A represents the results for the dependent variable response latencies, whereas Panel B represents the results for the dependent variable error percentages.

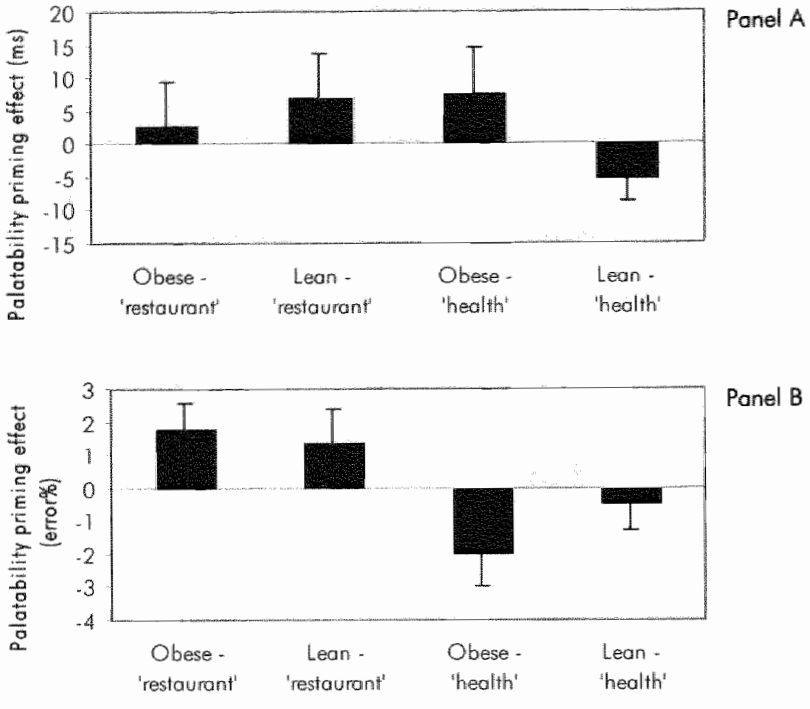


Figure 7.2 Experiment 1: The palatability priming effect as a function of participant group (obese vs. lean control) and manipulation (restaurant vs. health). The means are collapsed over the factor prime fat content. The palatability priming effect (RT and percentage of errors) for each participant is computed as: ((mean (palatable -) + mean (unpalatable+)) / 2) - ((mean (palatable+) + mean (unpalatable -)) / 2). In this formula, 'palatable' or 'unpalatable' indicates the palatability of the prime, whereas the plus or minus sign right behind it, indicates whether the target was positive or negative. A positive score indicates a preference for palatable foods over unpalatable foods, and a negative score indicates a preference for unpalatable foods over palatable foods. Error bars represent one standard error. Panel A represents the results for the dependent variable response latencies, whereas Panel B represents the results for the dependent variable error percentages.

Palatability priming effect - response latencies. In the analysis on response latencies, no evidence was found for any priming effects. See figure 7.2A for relevant means and standard errors.

Palatability priming effect - error percentages. The target affect × prime palatability manipulation interaction was significant, which suggests that participants in the 'restaurant condition' displayed an opposite palatability priming effect as compared to the participants in the 'health condition'. Results for participants in the 'restaurant condition' suggest a liking of palatable foods over unpalatable foods, in that participants made fewer errors on congruent (palatable food prime - positive target or unpalatable food prime - negative target) trials than on incongruent (unpalatable food prime - positive target or palat-

able food prime - negative target) trials. Results for participants in the 'health condition' are indicative of a reversed priming effect, in that participants made fewer errors on incongruent trials than on congruent trials. This reversed palatability priming effect in the 'health' condition suggests that palatable foods are seen as more negative (unhealthier) than palatable foods. This finding is in accordance with the results of the health rating task as described before, in which indeed unpalatable foods were rated as healthier than palatable foods. In a separate analysis for the 'restaurant condition', the target affect × prime palatability interaction was significant, whereas this target affect × prime palatability interaction was marginally significant, in a separate analysis for the 'health condition'. See Figure 7.2B for relevant means and standard errors. The factor group did not influence the palatability priming effect.

In sum

Results of the affective priming task suggest that the manipulation (restaurant task vs. health task) significantly influenced the direction of the priming effect, whereas no differences were found for the two groups (obese vs. lean control). So, a temporary change of attention focus prior to completing the affective priming task was effective in influencing the priming results. In the 'restaurant condition', taste appeared to be the basis for categorization of food, in that affective priming results suggest a liking of palatable foods over unpalatable foods. Results also suggest a more positive evaluation of high-fat foods than of low-fat foods as compared to the 'health condition'. In the 'health' condition, health appeared to be the basis for categorization of food. In this condition, results suggest a preference for unpalatable foods over palatable foods. This negative evaluation of palatable foods is in perfect accordance with the results of the health rating task in which palatable foods were indeed rated as unhealthier. Moreover, priming results also suggest a relative preference for low-fat foods over high-fat foods as compared to the 'restaurant condition'. Concluding, the results of Experiment 1 suggest that a temporary change in attention focus effectively influenced the priming effect, whereas weight status did not influence the direction or magnitude of the priming effect.

EXPERIMENT 2

In Experiment 1 we manipulated attention focus directly on a cognitive level. In Experiment 2 we are interested in the effects of a different manipulation - the induction of craving for food - on the priming effect. As described in the general introduction, a prior affective priming study with obese people in our laboratory found a more negative association with high-fat palatable foods than with low-fat palatable foods (Roefs et al., 2004). This finding might be explained by the health emphasizing context in which that study took place, a hospital. The current Experiment 2 took place in that same hospital, but prior to the affective priming task, participants were exposed to high-fat palatable foods (e.g., chocolate) to induce a state of craving for food. We expected this manipulation to have the effect of making the taste of food - instead of the healthiness of food - a salient characteristic, and thus the basis of categorization. Therefore we expected a positive palatability priming effect, in other words a liking for palatable foods over unpalatable foods on a relatively automatic level. Though in Experiment 1 we did not find evidence for the hypothesis that obese participants would show a more positive palatability priming effect than lean

controls, we again tested the effect of weight-status on the palatability priming effect in Experiment 2. Moreover, like in Experiment 1, the primes were also differentiated in fat content, to test whether effects would be specific for either high-fat or low-fat foods.

Method

Participants

Participants were 27 obese women (BMI > 30) and 29 female lean unrestrained eaters (BMI: 18.5 - 25). Restraint-status was again determined by the Restraint Scale, and a participant qualified as an unrestrained eater when she scored 14 or below. Obese participants were women who applied for gastric surgery at a local hospital. Some were on a waiting list for this operation, while others had been refused for this operation for various reasons. The lean controls were recruited by advertisements in local newspapers, by putting up advertisements in the hospital, and by asking participants whether they knew people who were willing to participate as well. The two groups of participants were matched on age and on time of testing. All participants were paid € 10 for their participation. See Table 7.3 for participant characteristics.

Several additional participants - not included in the groups described above - were tested, but were excluded from analyses based on beforehand defined exclusion criteria. Two obese participants were excluded because of medical problems with the thyroid gland, and two participants (1 obese and 1 lean control) were excluded because of a high percentage ($> M + 3\ SD$) of errors or responses that were either too fast or too slow, on the affective priming task.

Table 7.3 Experiment 2: Participant characteristics, means with SDs in parentheses

	Obese	Control	*t*	*df*	*p*
Age	36.4 (9.9)	35.8 (10.0)	0.23	54	.82
BMI	38.7 (5.8)	22.1 (1.5)	14.6	29.3[1]	<.001
Restraint Scale	19.1 (4.0)	8.8 (3.2)	10.7	54	<.001
Time of testing	12.9 (2.3)	12.8 (2.2)	0.15	54	.89
Craving pretest	24.8 (24.6)	44.1 (28.1)	2.73	54	<.01
Initial craving[2]	61.9 (21.2)	77.8 (14.5)	3.25	45.5[1]	<.05
Craving task onset[3]	82.3 (7.2)	81.7 (8.8)	0.25	54	.81
Craving average[4]	83.0 (6.0)	83.5 (6.8)	0.33	54	.74

[1] Equality of variances could not be assumed

[2] The craving score after the first 5 minutes of craving induction

[3]The craving score prior to starting the task, after possible 2-minute extensions of the craving manipulation to achieve the minimum value of 70

[4]The average of the three craving scores prior to the starting of each block, after possible 2-minute extensions of the craving manipulation.

The affective priming task

The specifications for the affective priming task were largely the same as in Experiment 1, with two exceptions. First, the apparatus running the experimental software was a Dell Inspiron 5000e notebook computer with a Pentium III processor, connected to a Philips Brilliance 105 monitor. Second, each trial started with a warning tone (200 ms), followed by a fixation cross (500 ms).

Materials

Food craving induction. The goal of this craving induction was to induce and maintain a state of craving for food during the affective priming task. Prior to the affective priming task, the extent of craving was first assessed on a 100 mm visual analog scale (VAS). This measurement will be referred to as the craving pretest (see Table 7.3). Then, the experimenter explained that it was very important for the current study to induce a state of craving for food. Three bowls with different kinds of foods (chocolate, croissant, and potato chips) were placed in front of the participant. If the participant did not like one of these foods, the item was replaced by a different food. The participant was then asked to intensely smell the food, and to eat a little bit of the food she liked best. The experimenter demonstrated and modeled how to smell the foods, and joined the participant in the craving induction procedure (c.f. Jansen, 1998). After a five minute craving induction, the extent of craving was again assessed on a VAS (this score will be referred to as the initial craving score). If this craving score was at least 70, the participant was ready to start the affective priming task. The food was left near the computer monitor, and the experimenter remained in the room during the computer task. If craving was not at the minimum level of 70, the craving induction was repeated for a two-minute period, after which craving was assessed again (maximum of three repetitions). Prior to blocks 2 and 3 of the priming task, the craving induction was repeated for 2 minutes, and was assessed again on a VAS scale. If craving was not maintained at a level higher than 70, the craving induction was repeated for a period of 2 minutes, with a maximum of three repetitions.

Procedure

Participants had all been asked not to consume any food during the two hours just prior to their participation. Compliance was checked by self-report before the start of the experiment. All participants complied with these instructions. Participants were tested individually in a quiet room in a local hospital, in the presence of the experimenter. The procedure was largely identical to the procedure in Experiment 1. The exception of course being that - instead of the 'attention focus manipulations' - the craving induction procedure was included between the practice trials and the start of the actual priming task, and just prior to blocks 2 and 3. The participant was briefly questioned about her medical history, the Restraint Scale (Herman & Polivy, 198) was completed, and height and weight were measured at the end of the experiment.

Design and analysis procedure

Data were analyzed using a 2 (target affect: positive vs. negative) × 2 (fat-content prime: high-fat vs. low-fat) × 2 (palatability of prime: palatable vs. unpalatable) × 2 (group: obese vs. control) analysis of variance. Target affect, fat-content prime, and palatability of prime were within subjects-factors, whereas the factor group was obviously a between-subjects factor. Partial eta squared (η^2) is reported as a measure of effect size for all analyses.

Results and discussion

Results affective priming paradigm[4]

The reported analyses are for the dependent variable response latency only, because analyses on error percentages did not yield significant relevant results (all p values > .117). Response latencies associated with responses that were either too fast (< 200 ms) or too slow (> 2000 ms) were discarded, a total of only 0.56% of all trials. Response latencies associated with error responses (3.5%) were also discarded. The assumption of equality of variances was checked per within-subjects contrast across the between-subjects groups with the Levene's Test of equality of error variances, and was not rejected. See Table 7.4 for all statistics.

Table 7.4 Experiment 2. All effects that are relevant for our hypotheses are reported in this Table, and will be printed in bold when they are (marginally) significant. Significant, but for the hypothesis irrelevant, effects will also be reported (bottom two rows). Irrelevant insignificant effects (all p-values > .13) will not be reported.

Effect	$F(1, 54)$	p	η^2
target × prime-fat	0.003	.96	<.001
target × prime-fat × group	1.11	.30	.02
target × prime-pal	0.81	.37	.02
target × prime-pal × group	1.62	.21	.03
target × prime-fat × prime-pal	**4.21**	**<.05**	**.07**
within HF: target × prime-pal	*0.57*	*.46*	*.01*
within LF: target × prime-pal	**3.20**	**.08**	**.06**
target × prime-fat × prime-pal × group	0.03	.86	.001
target	33.56	<.001	.38
prime-fat	4.81	.03	.08

Note: target = target affect, prime-pal = prime palatability, prime-fat = prime fat-content; HF = high-fat foods; LF = low-fat foods

Contrary to hypothesis, the manipulation did not have the effect of a simple palatability priming effect (i.e., a liking of palatable foods over unpalatable foods), as was evident from the nonsignificant target × prime palatability interaction, nor was this effect different between the two groups as was evident from the nonsignificant target × prime palatability × group interaction. Unexpectedly, the palatability priming effect was more positive

[4]Analyses were also performed on the log-transformed latencies, by computing the natural logarithm of each mean RT per condition. This did not lead to different results or conclusions for either the ANOVA or the correlational analyses.

for low-fat foods than for high-fat foods, as was evident from the three-way target × prime palatability × prime fat content interaction (see Figure 7.3). This three-way interaction suggests that health aspects significantly influenced the palatability priming effect. In a separate analyses for the low-fat foods, the target × prime palatability interaction was marginally significant, whereas this interaction was absent for the high-fat foods.

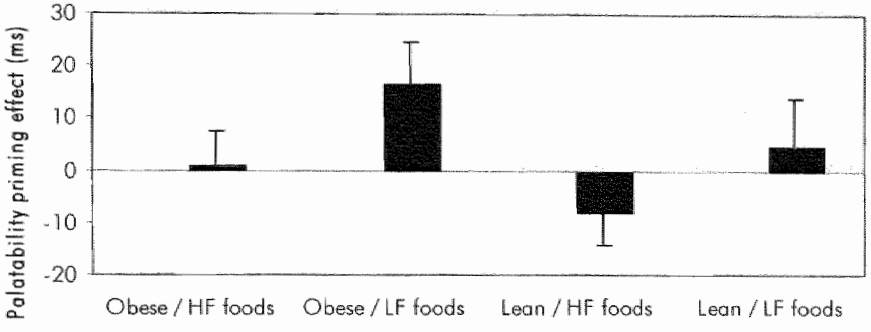


Figure 7.3 Experiment 2: The palatability priming effect as a function of participant group (obese vs. lean control) and fat content of the food prime (high-fat vs. low-fat). The palatability priming effect for each participant is computed as: ((mean (palatable -) + mean (unpalatable+)) / 2) - ((mean (palatable+) + mean (unpalatable -)) / 2). In this formula, 'palatable' or 'unpalatable' indicates the palatability of the prime, whereas the plus or minus sign right behind it, indicates whether the target was positive or negative. A positive score indicates a preference for palatable foods over unpalatable foods, and a negative score indicates a preference for unpalatable foods over palatable foods. Error bars represent one standard error.

Correlational Analysis palatability priming effect

The goal of our craving induction procedure was to induce a similar degree of craving in all participants (VAS rating between 70 and 100). VAS ratings suggest that the two groups of participants (obese vs. lean controls) indeed experienced similar degrees of craving at task onset, and on average during the task (see Table 7.3). Moreover, within each group, neither the craving score at task onset (obese: $r = .07$, $p = .74$; lean controls: $r = .12$, $p = .52$), nor the average craving score (obese: $r = .19$, $p = .34$; lean controls: $r = .09$, $p = .64$) correlated significantly with the palatability priming effect (calculated as the difference score between incongruent (palatable - negative / unpalatable - positive) and congruent (palatable - positive / unpalatable - negative) trials).

However, a possible correlation might have been obscured because of the restricted range (70-100). Moreover, these scores might have been influenced by socially desirable answering tendencies. The craving score at task onset and the average craving score reflect craving after (if needed) 2-minute extensions of the craving induction, to achieve the required level of craving (70). The experimental demand can reasonably be expected to have played a larger role at later assessments of craving (after 2-minute extensions) because participants knew that they were supposed to be in a state of craving, and might have indicated after repetitions that their craving was high just to be able to continue the task.

For these two reasons, we also looked at correlations between initial craving (i.e., the craving score after the first 5 minutes of the craving induction which could vary between 0 and 100) and the palatability priming effect. As can be seen in Table 7.3, lean controls scored higher on initial craving than obese participants. Moreover, this difference between groups was also apparent on the pretest. Interestingly, in the obese group, the palatability priming effect correlated significantly with initial craving, $r = .49$, $p < .01$, whereas it did not correlate with pretest craving, $r = .06$, $p = .78$. For the lean control group, the palatability priming effect was positively, but nonsignificantly, correlated with initial craving, $r = .29$, $p = .13$, and not correlated with pretest craving, $r = .03$, $p = .88$ (See Figure 7.4). Note that part of the variability in initial craving scores within each group might reflect sensitivity for craving, in that some participants may easier be brought in a state of craving. Another part of the variability in craving scores might reflect the degree to which participants fully immersed themselves in the craving induction.

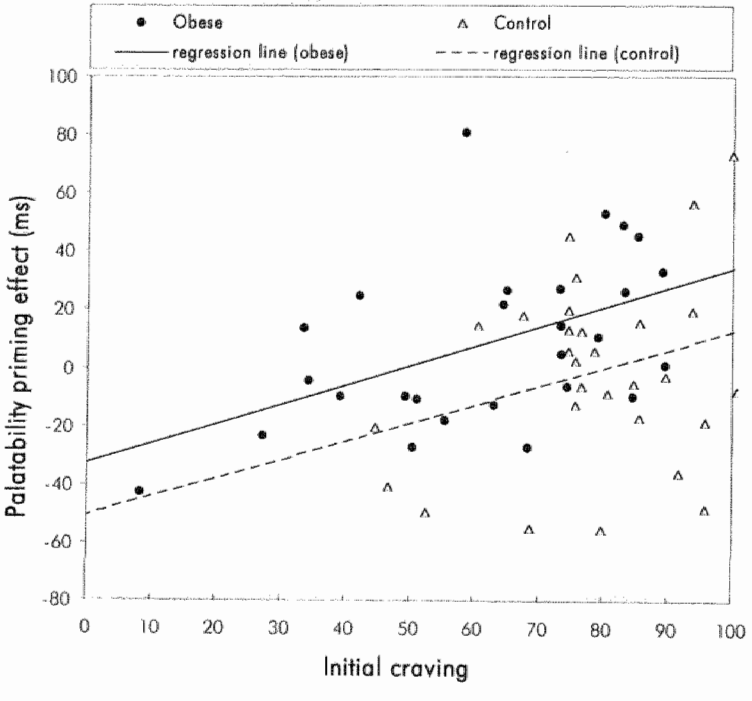


Figure 7.4 Experiment 2: The palatability priming effect as a function of the initial craving score. The means are collapsed over the factor prime fat content. The palatability priming effect (RT and percentage of errors) for each participant is computed as: ((mean (palatable-) + mean (unpalatable+)) / 2) - ((mean (palatable+) + mean (unpalatable -)) / 2). In this formula, 'palatable' or 'unpalatable' indicates the palatability of the prime, whereas the plus or minus sign right behind it, indicates whether the target was positive or negative. A positive score indicates a preference for palatable foods over unpalatable foods, and a negative score indicates a preference for unpalatable foods over palatable foods. Obese and lean control participants are represented by separate fitted regression lines.

Note that the group differences on the pretest and the initial craving score (see Table 7.3) may not reflect a true difference in craving, but may simply mean that the obese participants felt more inhibited to admit their craving on the VAS scale in comparison to the lean controls. To prevent a possible Type I error (falsely concluding a larger priming effect for the obese group than the lean controls, which was the effect of entering initial craving as a covariate), we decided not to include any of these variables as a covariate, but instead to report correlations separately for each group.

In sum

Interestingly, correlational analyses suggest that the palatability priming effect was related to initial craving for the obese group, in that the palatability priming effect was more positive with higher initial craving scores. This effect was in the same direction for the lean controls, but was not significant. These data may be taken as evidence that a craving induction works somewhat better for obese people than for lean people, in that they showed a more positive priming effect with higher initial craving scores.

As was evident from the ANOVA, the craving manipulation did not simply lead to a palatability priming effect - a liking for palatable foods over unpalatable foods on a relatively automatic level - for all participants. Unexpectedly, the palatability priming effect was more positive for low-fat foods than for high-fat foods. This suggests that health aspects still might have played a role, possibly due to the hospital environment. The craving induction did not achieve its goal of focusing all participants on the palatability aspects of food in general, but just for the low-fat foods.

GENERAL DISCUSSION

Relatively automatic evaluations of food certainly seem malleable. In Experiment 1, the focus of attention was manipulated by a short task that either focused on the palatability of food or on the health aspects of food. This manipulation had the expected effect on the priming effect. When attention was focused on the palatability of foods, relatively automatic associations with food were indeed based on palatability, in that participants displayed a preference for palatable foods over unpalatable foods, and compared to the health condition a greater preference for high-fat foods than low-fat foods. When attention was focused on health, relatively automatic associations with food were indeed based on health, in that participants displayed a preference for unpalatable (healthier) foods over palatable foods, and compared to the restaurant condition a greater preference for low-fat foods than for high-fat foods. The findings of Experiment 1 are comparable to findings of a recent study about attitudes toward smoking, in which attention was either focused on the sensory aspects of smoking or on the negative aspects of smoking such as health concerns and costs (Sherman, Rose, Koch, Presson, & Chassin, 2003). In that study, participants displayed a positive priming effect for the picture stimuli that were related to the sensory aspects of smoking, whereas they displayed a negative priming effect for the picture stimuli that were related to the negative aspects of smoking.

In Experiment 2, for obese people the palatability priming effect became more positive with higher levels of initial craving. For lean controls, the effect was in the same direction but missed significance. Again, a parallel can be drawn with the research of Sherman et al. (2003) in which it was shown that deprived heavy smokers had more positive associations

with smoking than similarly deprived light smokers. Note that the difference between obese and lean controls in our study was found in the correlational analyses, not in the analysis of variance. Moreover, Lozano, Crites, & Aikman (1999) found that people rated foods more positively when in a state of hunger. Lozano et al. (1999) suggest that a state of hunger may increase the salience of the palatability aspects of food, and reduce the salience of health-related beliefs. Unexpectedly, in the current Experiment 2, the palatability priming effect was more positive for low-fat than for high-fat foods, suggesting that health concerns still might have played a role. This might be explained by the health-emphasizing environment, a hospital.

In a prior study in our laboratory, we compared high and low restrained eaters on food (dis)likes in the same affective priming paradigm and in a related paradigm (Roefs et al., in press). Both of these studies were conducted in a relatively neutral environment (university), and all participants, independent of restraint status, preferred palatable foods over unpalatable foods. So, restrained and unrestrained eaters seemed to like foods to the same extent. Though restrained and unrestrained eaters did not differ in their relatively automatic evaluations of food, we hypothesized that they might differ in their craving for these foods ('wanting'; see e.g., Gendall & Joyce, 2001; Klajner, Herman, Polivy, & Chhabra, 1981; Legoff & Spigelman, 1987). In other words, they may like foods to the same extent, but may independently differ in their 'wanting' of those foods (Berridge, 1996). So, the affective priming paradigm is then assumed to measure a relative liking, not a relative wanting of food.

Results of the current Experiment 2 suggest that the mechanism might be a little more complicated. When obese people experience higher levels of initial craving ('wanting'), they seem to prefer palatable foods over unpalatable foods to a greater extent, suggesting that palatability is a highly relevant characteristic of food then. In other words, a state of craving makes the palatability related aspects of food salient, and thus the basis of categorization. It might be hypothesized that the same is true for restrained eaters. Restrained eaters may not be in a permanently heightened state of craving. However, after a craving induction, restrained eaters may have a stronger preference for palatable foods over unpalatable foods.

As was briefly alluded to in the introduction, instead of considering attitudes and evaluations as fixed entities, it might thus be more appropriate to view evaluations or attitudes as online reconstructions that are influenced by the immediate situation and the current focus of attention (Mitchell et al., 2003). Applied to the evaluation of food, a food certainly is multiply categorizable (Smith et al., 1996), and which aspect of food is important for evaluation (health concerns vs. palatability) is determined by the current focus of attention (being a chef in a restaurant vs. information on healthy eating habits), by the current situation (e.g., initial degree of experienced craving and possibly location), and by weight-status. Interestingly, when evaluations of food are assessed in a relatively neutral environment, palatability seems to be the basis of categorization (Roefs et al., in press) and thus determines the direction of the priming effect. This may not be surprising because palatability is considered the most important aspect of food (Eertmans et al., 2001). As was shown in the current experiments, the importance of palatability can be changed by the current focus of attention and for obese people by the degree of initial craving.

So, when people are in a certain situation in which the palatability of food is a very salient characteristic, they might forget about the health aspects of food, and not categorize foods in terms of health. This could encourage selecting and eating foods solely based

on taste. When it comes to experienced craving, especially obese people may have increasingly positive associations with palatable foods. Interestingly, Mann and Ward (2004) found that restrained eaters ate more when the food itself was salient than when diet was made salient, when under high cognitive load. This high cognitive load caused participants to narrow their attention to only those salient cues ('diet' vs. 'appetizing'). However, because situations and focus of attention can change relatively quickly, positive associations with palatable foods may quickly be overridden by more health-based negative associations. Imagine for example that you are walking through a street lined with nice restaurants, filled with the smell of good food. This would possibly make you think of the palatability of food. However, when you walk a little further, you may encounter a fitness gym, or a big advertisement for beach wear, which brings your focus back on the healthiness of food.

Recent studies and theorizing about obesity emphasize the role of the so-called 'toxic environment' in which we live (Hill & Peters, 1998; Wadden et al., 2002). "Our genes have not changed substantially during the past two decades. The culprit is an environment which promotes behaviors that cause obesity" (Hill & Peters, 1998, p. 1371). On the other hand, beauty and being slim is considered very important in our society in which obesity is stigmatized (Puhl & Brownell, 2003; Teachman & Brownell, 2001). Obese people do realize that, as they often score high on measures of restraint (Fairburn & Cooper, 1993). However, the palatability of food may be too salient in the environment, and the health aspects might be emphasized too little. Moreover, obese people may start avoiding places in which health is very salient (such as sports, see e.g., Lahti-Koski, Pietinen, Heliövaara, & Vartiainen, 2002), whereas they might more often be in an environment in which the palatability of food is salient. Moreover, obese people may perceive their environment differently, and selectively attend to the palatability related aspects of food. Relatedly, Mogg, Bradley, Hyare, and Lee (1998) found that hungry participants showed a larger attentional bias for food related words than less hungry participants. Whether this also applies to obese people remains an issue for future research. Concluding, our toxic environment with many reminders of palatable foods, combined with studies suggesting that obese people and restrained eaters are in general more impulsive (Chalmers, Bowyer, & Olenick, 1990; Nederkoorn, Braet, Van Eijs, & Jansen, 2004; Nederkoorn, Van Eijs, & Jansen, in press) might contribute to an explanation of the sudden rise in obesity.

Wing and Hill (2001) showed that successful weight loss can be achieved by a combination of exercise, a low-fat and high-carbohydrate diet, and keeping track of ones weight. Their data also suggest that weight loss gets easier over time, which might be explained by a focus on health instead of palatability. When you are not constantly reminded of the palatability of food, it might be easier to avoid fattening palatable foods. Moreover, it may be suggested that it would be better to avoid extremely low calorie diets, because these diets may induce a state of deprivation which possibly leads to craving, which in turn makes the palatability of food salient. A longer lasting - but less extreme - change of lifestyle, with a focus on health might be more advisable (Miller, 1999).

Appendix: stimuli

Primes

High-fat palatable foods: chocola (chocolate), chips (chips), friet (fries), croissant (croissant), pizza (pizza), roomijs (ice cream)

High-fat unpalatable foods: haring (herring), speklap (slice of bacon), pate (pate), boter (butter), pindakaas (peanutbutter), walnoten (walnuts)

Low-fat palatable foods: aardbeien (strawberries), druiven (grapes), meloen (melon), kip (chicken), popcorn (popcorn), drop (liquorice)

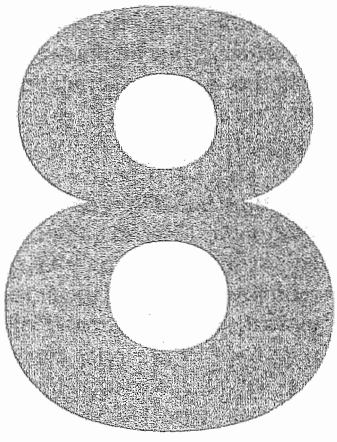
Low-fat unpalatable foods: spruiten (Brussels sprouts), witlof (chicory), zuurkool (sauerkraut), andijvie (endive), radijs (radish), kabeljauw (cod)

Targets

Positive targets: vrede (peace), trouw (loyalty), zomer (summer), knuffel (hug), romantiek (romance), zonneschijn (sunshine), humor (humour), lente (spring), geschenk (gift), verrassing (surprise), cadeau (gift), baby (baby), feest (party), schoonheid (beauty), geboorte (birth), bruid (bride), bloesem (blossom), verjaardag (birthday), regenboog (rainbow), vlinder (butterfly), wens (wish), hemel (heaven), boeket (bouquet), melodie (melody)

Negative targets: oorlog (war), haat (hatred), ongeluk (accident), drugs (drugs), werkloosheid (unemployment), ongeval (accident), pijn (pain), dood (dead), scheiding (divorce), puist (pimple), zorgen (worries), roddel (gossip), belediging (insult), verdriet (grief), afval (garbage), schade (damage), angst (fear), schuld (guilt), vrees (fear), examens (exams), gebrek (defect), paniek (panic), vuilnis (garbage), mug (mosquito)

OVERVIEW OF EMPIRICAL FINDINGS, CONCLUSIONS, AND FUTURE RESEARCH



In this thesis, three types of indirect measures were used to address the central question of whether an increased 'pleasure of food' is related to overeating and obesity, and whether a decreased 'pleasure of food' is related to undereating - anorexia nervosa - when this 'pleasure of food' is assessed at an early stage of cognitive processing. Prior research suggests that palatability may be more important for obese people than for lean controls (e.g., Pliner, Herman, & Polivy, 1990). Moreover, research also suggests that obese people consume and like high-fat foods to a greater extent than lean controls do (e.g., Lissner & Heitmann, 1995; Rissanen et al., 2002). Another group of people who were hypothesized to specifically like high-fat palatable foods were the restrained eaters. In the literature, restrained eating is hypothesized to be associated with (high-fat) palatable foods being extra desirable (Gendall & Joyce, 2001; Stice, 2002). So, for both groups - obese people and restrained eaters - the hypothesis was tested that they would show a specific liking for high-fat palatable foods in comparison to normal controls. The rationale for studying these automatic associations was that if obese people and restrained eaters indeed were shown to have a stronger preference for palatable (high-fat) foods on a relatively automatic level than lean controls, it would be expected that they always experience this association, and always have to suppress it to be able to successfully inhibit their food consumption. Moreover, it would also suggest that an intervention aimed at the level of controlled processing would be rather inefficient, and should better be targeted at these automatic associations.

For anorexia nervosa patients, both Pinel Assanand, and Lehman (2000) and Jansen (1998, 2001) proposed that food may have lost its incentive value. Moreover, anorexia nervosa patients may have a deficit in experiencing pleasure (Davis & Woodside, 202). This deficit may make food restriction easier in that food may no longer be seen as something that can be palatable or unpalatable. For anorexia nervosa patients, the hypothesis was tested that they would show a decreased sensitivity to the palatability of food in comparison to lean controls. If that hypothesis was confirmed, a therapy for anorexia nervosa patients might also better be directed at these relatively automatic associations.

Indirect measures were used to address our central question, mainly because we were interested in relatively spontaneous evaluations of food. In this chapter, we will first provide an overview of the empirical findings, which will be followed by conclusions that can be drawn from these findings. When we use the term 'relatively automatic', we intend it like we described it in Chapter 2, in that the processes assessed by different indirect measures meet at least some criteria for automaticity. As will become clear in the overview of empirical findings, findings for similar groups of participants sometimes differed between paradigms. Though these indirect measures 'belong to one family', they differed more than was expected, possibly because different theoretical mechanisms underlie different indirect measures. These methodological issues will also be briefly addressed. Finally, some thoughts about future research will be presented, regarding both eating related issues and methodological issues.

OVERVIEW OF EMPIRICAL FINDINGS

In the first experiment (Chapter 3), we used the IAT (Greenwald, McGhee, & Schwartz, 1998) to test the hypothesis that obese people would show a stronger relatively automatic preference for high-fat foods than lean controls. Results suggest exactly the opposite, in

that all participants preferred low-fat foods over high-fat foods on a relatively automatic level, and this effect was most pronounced for the obese people. Should these findings be taken as evidence that our theory is wrong? Might it be the case that obese people simply are not characterized by a specific liking for high-fat palatable foods? In Chapter 3, we suggest that this conclusion might be a bit premature and an alternative interpretation is offered. The findings were explained in terms of De Houwer's (2001) structural and process analysis of the IAT. De Houwer (2001) showed that the IAT effect is largely driven by the category labels (see also Mitchell, Nosek, & Banaji, 2003). So, instead of measuring an association with the individual exemplars (e.g., chocolate), we measured associations with the categories 'high-fat' and 'low-fat'. It may not be too surprising that (especially obese) people have negative associations with the high fat content of foods, though they may obviously like the taste of, for example, chocolate.

To overcome this problem of predefined categories (high-fat vs. low-fat), we decided to test our hypothesis for overeaters in two different paradigms, namely the affective priming paradigm (Fazio, Sanbonmatus, Powell, & Kardes, 1986) and the EAST (De Houwer, 2003b). In Chapter 4, two experiments are reported that compared restrained eaters to unrestrained eaters. In both experiments, one using the affective priming paradigm (Fazio et al., 1986) and the other using the EAST (De Houwer, 2003b), all participants displayed a liking of palatable foods over unpalatable foods on a relatively automatic level. Results were not influenced by participants' restraint status or the fat content of the foods. So, all participants responded on the basis of the palatability of the foods. It might be tempting to conclude now that restrained and unrestrained eaters do not differ in their responsiveness to food. However, though restrained and unrestrained eaters did not differ in their liking of food at a relatively automatic level, they may still independently differ in their craving ('wanting') for these foods (see Berridge, 1996). The indirect measures that we use may tap the palatability or liking of the food independent of craving for that food.

To test whether obese people showed an increased liking of high-fat palatable foods, we tested a group of obese people and a group of lean controls in the affective priming paradigm (Chapter 5, Experiment 2). Results of this experiment suggest that the fat content of the foods was evaluated negatively by all participants. All participants displayed a preference for low-fat palatable foods over high-fat palatable foods. This again suggests that health or weight concerns influenced (obese) participants' responding. These results were a bit surprising, because the affective priming paradigm can be considered neutral, in that participants are not required to sort the prime stimuli into predefined categories (c.f. IAT: high-fat vs. low-fat). Again, these results are in contrast with our hypothesis of an increased liking of high-fat palatable foods in overeaters as compared to normal controls. A possible explanation for not finding the same pattern of results as in the affective priming experiment reported in Chapter 4 could be that the obese participants responded relatively slowly as compared to the participants of Experiment 1 of Chapter 4, leaving too much time for more controlled processing. However, the priming effect of the lean control group (Experiment 2 in Chapter 5) did not differ from the obese group, whereas they were not as slow. So speed is not the only explanation. Possibly, the context in which the experiment took place, namely a hospital, an environment in which health is obviously salient, played a role. As Blair (2002) reviews, very subtle context manipulations can influence indirect measures. This possibility was addressed more specifically in Chapter 7.

In the first experiment of Chapter 5, we compared a group of anorexia nervosa patients to a control group of lean unrestrained eaters in the affective priming paradigm. We test-

ed the hypothesis that anorexia nervosa patients would show a reduced sensitivity to the palatability of food at a relatively automatic level. The results of this experiment confirmed the hypothesis, in that the lean control group showed a palatability priming effect, whereas this effect was absent in the anorexia nervosa group. These results show that anorexia nervosa patients did not automatically categorize foods as either palatable or unpalatable. These data indicate that the palatability of food no longer is important for anorexia nervosa patients, which in turn might make food restriction easier. Note however that the anorexia group responded relatively slowly in comparison to the lean control group, which might have left too much time for controlled processing for an affective priming effect to occur. Exactly why the anorexia patients responded so slowly is unclear. This might reflect the fact that food is a source of worries for them and therefore captures their attention relatively long (c.f. the emotional Stroop effect; Williams, Mathews, & MacLeod, 1996), or they might simply be cognitively slower (Green, Elliman, Wakeling, & Rogers, 1996).

The slowness of responding of both the obese group and the anorexia group (Chapter 5) might suggest that some time was left for more controlled processing. In Chapter 6 we examined the effects of more controlled processing of food information on subsequent consumption, thereby comparing a group of overweight and obese people to a group of lean controls. Obese people may like high-fat foods to a greater extent, but they also frequently score higher on measures of restrained eating than lean controls, as was also the case in the experiment reported in Chapter 6. In this experiment, participants were given fake information regarding the fat content of two dairy products that they were asked to taste in a staged taste-test. Milkshakes were either labeled as high-fat or as low-fat. The hypothesis was that participants would consume less of the dairy product labeled as high-fat than of the one labeled as low-fat, and that the effect would be stronger for the obese group than for the control group. The label-effect was significant and in the expected direction of less estimated future consumption in the high-fat label condition. The label-effect was not significant for actual consumption. Unexpectedly, order (label high-fat first vs. label low-fat first) had a large effect on consumption, which makes interpretation of the data difficult. Weight-status did not influence results.

As was briefly alluded to before (see Chapters 2 and 5), context and focus of attention might play an important role in automatic associations (see Blair, 2002). In the Western world, palatable high-fat foods are abundant, and on almost every street corner one is reminded of some kind of nice food. It is likely that the environment exerts its influence on relatively automatic evaluations by shaping the way food is conceptualized (Mitchell et al., 2003; see Chapter 2). Chocolate for example can either be conceptualized as a very palatable food, or as an unhealthy fattening food. The environment may trigger how you conceptualize the food on that moment, by making certain associations more available than others (Smith, Fazio, & Cejka, 1996). The goal of the experiments reported in Chapter 7 was to investigate how the environment influences relatively automatic associations with food.

In the first experiment reported in Chapter 7, we manipulated the focus of attention by having participants read a script and have them answer some questions. Half of the participants were asked to imagine that they were a restaurant owner about to prepare a fancy dinner. The other half of the participants were given information about healthy eating. These manipulations proved to be effective in influencing the affective associations, in that the priming effect for people in the restaurant condition was based on palatability, whereas it was based on health concerns for people in the healthy food condition. Weight-status

(obese vs. lean control) did not influence the priming results. In the second experiment reported in Chapter 7, we attempted to focus participants on the palatability of food by inducing craving for food. For obese people, the level of initially experienced craving correlated positively and strongly with the palatability priming effect (i.e., greater liking of palatable foods over unpalatable foods with greater craving), whereas this correlation was positive but nonsignificant for the lean controls. Unexpectedly, for the group as a whole, the palatability priming effect was more positive for low-fat foods than for high-fat foods. This finding may be explained by the fact that the experiment took place in a health emphasizing environment, a hospital.

In sum, the experiments reported in Chapter 7 suggest that our 'toxic' environment (Wadden, Brownell, & Foster, 2002) plays an important role in our relatively automatic evaluations of food. Because, high-fat palatable foods are available on almost every street corner, providing many 'palatability-cues', positive evaluations of these foods may easily and relatively automatically be triggered. Obese people's environment may contain more of these 'palatability cues', and they may have an attentional bias for these cues (see also Mogg, Bradley, Hyare, & Lee, 1998).

CONCLUSIONS

1. Prior research suggests that the palatability of food is more important for obese people than for lean controls. Moreover high-fat (palatable) foods were found to be specifically preferred by obese people and are hypothesized to be extra desirable for restrained eaters (e.g., Gendall & Joyce, 2001; Lissner & Heitman, 1995; Pliner et al., 1990; Rissanen et al., 2002; Stice, 2002). Our first main hypothesis was that overeating would be related to an increased pleasure of food at an early stage of cognitive processing. However, in this thesis, no stable differences in relatively automatic food evaluations between overeaters (obese people and restrained eaters) and normal controls were found in the expected direction. A difference between obese people and lean controls was found in the IAT study reported in Chapter 3. This difference was in the opposite direction. All participants had more positive associations with low-fat foods than with high-fat foods at an early stage of cognitive processing, and this effect was most pronounced for the obese group. The IAT findings were explained by the specific characteristics of this methodology which induced a focus on fat content.

2. In the second study of Chapter 7 we induced a state of craving in the participants. Though the findings of this study do not represent stable associations with food, increasing levels of experienced initial craving were associated positively with obese people's automatic evaluations of food. Greater craving was associated with a greater liking of palatable foods over unpalatable foods. For lean controls the degree of craving was not reliably related to their automatic associations with food.

3. Food is hypothesized to have lost its incentive value for anorexia nervosa patients (Jansen, 1998, 2001; Pinel et al., 2000). Our second main hypothesis was that undereating (anorexia nervosa) would be related to a decreased pleasure of food at an early stage of cognitive processing. The results of the study reported in Chapter 5 support this hypothesis and suggest that anorexia nervosa patients are less sensitive to the palatability of food than lean unrestrained eaters. The experiment with anorexia nervosa patients took place in a relatively neutral environment (university) and used a relatively 'bias-free' paradigm, as

did the studies with overeaters in Chapter 4. In the experiments of Chapter 4, a preference for palatable foods over unpalatable foods was found, which was not modified by restraint-status or fat content. So, in a relatively neutral environment and paradigm, anorexia nervosa patients were the only group not showing a relative preference for palatable foods at an early stage of cognitive processing. Note however that the anorexia nervosa patients responded relatively slowly in comparison to the lean controls.

4. Environment actually seems to play the most important role in relatively automatic food evaluations. The IAT study (Chapter 3) unintentionally focused attention on health by having participants categorize foods as either high-fat or low-fat. In this IAT study, low-fat foods were preferred over high-fat foods. The study with obese participants reported in Chapter 5 took place in a hospital, which may also have emphasized health aspects. Participants preferred low-fat palatable foods over high-fat palatable foods in this study. Note that in a relatively neutral environment (university), the evaluation of food was based on palatability, and palatable foods were preferred over unpalatable foods (Chapter 4, control group study 1 in Chapter 5). Because palatability is considered the most important factor determining food choice (Eertmans, Baeyens, & Van den Bergh, 2001), it may not be surprising that an evaluation of food in a relatively neutral environment is based on palatability.

In the studies reported in Chapter 7, we intentionally manipulated the salience of palatability and health aspects of food. Interestingly, the relatively automatic evaluations of food were influenced by both the current focus of attention, and for obese people by the degree of experienced initial craving. In Experiment 1 (Chapter 7), if the manipulation focused on palatability aspects, a relatively automatic evaluation of the foods was based on palatability. If the manipulation focused on health aspects, a relatively automatic evaluation was based on the healthiness of the foods. This finding is important because our environment is characterized by an abundance of high-fat palatable foods (Hill & Peters, 1998) in increasingly large portions (Nielsen & Popkin, 2003). Everywhere around us we are reminded of palatable high-fat foods, whereas health related cues obviously exist but may be less abundant. This may lead to a categorization of food into palatable and unpalatable, and thereby to relatively automatic evaluations based on palatability. So, people may not be reminded of the health consequences of food often enough. Whether this leads to higher consumption of (high-fat) palatable foods remains an issue for future research. Interestingly, Mann and Ward (2004) found that high-restrained eaters ate more in a situation in which the food itself was made salient than when their diet was made salient, when under high cognitive load.

But why then are some people successful at staying slim, whereas a large proportion of the Western world is overweight? Notably, the palatability priming effect was related to the experienced level of initial craving for the obese, but not for the lean controls (Chapter 7). Moreover, obese people's environment may differ in some ways from the environment of lean people, and they may perceive their environment differently by selectively attending to mostly palatability related cues. Obese people may for example start avoiding sports, an environment in which health cues are obviously very salient. A recent study by Lahti-Koski, Pietinen, Heliövaara, and Vartiainen (2002) in fact suggests that overweight people are less physically active at leisure time. Moreover the family food environment may be different. Several studies found a resemblance in food intake within a family (Feunekes, de Graaf, Meyboom, & van Staveren, 1998; Mitchell et al., 2003). Heavier parents tend to have heavier children (Cutting, Fisher, Grimm-Thomas, & Birch, 1999), which may in part be

explained by the family food habits.

METHODOLOGICAL ISSUES

The research reported in this thesis suggests that the affective priming paradigm and the IAT may not assess the same underlying construct. The lean unrestrained control group in the IAT study (Chapter 3) evaluated high-fat foods negatively, whereas lean unrestrained control groups in the affective priming studies reported in Chapter 4 and Chapter 5 (Experiment 1) evaluated foods based on palatability, and did not display evidence of negative associations with high-fat foods. Assuming that the groups of participants did not differ substantially in their food likes at an early level of cognitive processing, this suggests that the two paradigms tap different mechanisms. As was noted before, the IAT procedure that we used made the fat content a highly salient feature of the foods by having participants categorize these foods as either high-fat or low-fat. Interestingly, Olson and Fazio (2003) manipulated the basis of categorization in the affective priming paradigm. The IAT and the affective priming paradigm only correlated when the basis of categorization in the affective priming paradigm was manipulated to be the same as in the IAT. Also, research by Bosson, Swann, and Pennebaker (2000) suggests that indirect measures of self esteem are only very weakly or not correlated.

An obvious explanation for these often low correlations between diverse indirect measures may be found in their theoretical underpinnings. The IAT (Greenwald et al., 1998) does not have a long history yet, and was intended as a measure of associations between a concept category and an attribute category, and attempts to measure relatively automatic attitudes. As Greenwald et al. (1998) note, the IAT procedure has a similar goal as the affective priming paradigm (Fazio et al., 1986). However, several researchers recently discovered alternative mechanism that can explain (part of) the IAT effect. First, as was already mentioned before, De Houwer (2001) discovered that the category labels are very important for the IAT effect, and the direction of the IAT effect is strongly influenced by these labels. De Houwer's (2001) model can perfectly explain the differences between our IAT study (categories: high-fat vs. low-fat) and our affective priming studies (no pre-defined categories). Second, Mierke en Klauer (2003; see also McFarland & Crouch, 2002) showed that the IAT is confounded by participants' cognitive skills, in that a non-attitude (neutral) IAT correlated with an attitude IAT. This means that the IAT effect contains method-specific variance, apart from content-specific variance. However, note that the improved scoring algorithm that was developed by Greenwald, Nosek, and Banaji (2003) reduces the influence of this cognitive skill confound. Third, Rothermund and Wentura (2001, 2004) recently introduced their figure-ground model to explain IAT effects. Negative and relatively unfamiliar stimuli tend to constitute the figure, whereas positive and relatively familiar stimuli tend to constitute the ground. In four experiments, Rothermund and Wentura (2004) convincingly showed that figure-ground asymmetries instead of evaluative associations can account for IAT effects. The EAST (De Houwer, 2003b) can be seen as an adaptation of the IAT, in which the influence of category labels is avoided, and is structurally similar to the Simon task (De Houwer, 2003a). No specific theories have been tested for the EAST yet.

Admittedly, though the affective priming paradigm has a longer history, the debate about which theory explains the affective priming effect best has not ended. Klauer and

Musch (2003) review three different accounts of the affective priming effect. Importantly, and different from the IAT theories, the theories that are proposed for the affective priming effect all rely on affective associations. A first account is the spreading activation account (Neely, 1991). The main idea is that the presentation of a prime activates its node in a lexical network, and also activates nodes that are affectively congruent with the prime. Nodes that are affectively incongruent with the prime are not activated. Because it may seem unlikely that a prime activates all other nodes that share the same valence, it might be better to adopt a distributed memory model (e.g., see Masson, 1995). In a distributed model, stimuli that share the same valence are assumed to share partly the same pattern of activation over distributed nodes. This spreading activation predicts and can explain affective priming effects in the naming task. However, as was discussed in Chapter 2, affective priming effects in the naming task with word stimuli are found inconsistently. Note - as was also briefly addressed in Chapter 2 - affective priming effects with the naming task can be found when the semantic system is involved. Involvement of the semantic system depends on the specific characteristics of stimuli (e.g., words vs. pictures) and instructions (e.g., conditional naming task).

An alternative mechanism that can explain some findings in the affective priming paradigm is a Stroop like mechanism, as proposed by Musch (2000, in Klauer & Musch, 2003). Evidence regarding the correct response accumulates from both the prime and the target. When the prime and the target are congruent, the accumulated evidence reaches a certain threshold sooner, and therefore a response can be executed faster as compared to when the prime and the target are incongruent. This explanation of affective priming effects can only account for findings with the evaluation task, "because only response-relevant prime information is integrated" (Klauer & Musch, 2003, p. 24). As De Houwer (2003a) notes, prime-target and prime-response compatibility are perfectly confounded in the affective priming paradigm with the evaluation task.

A final account that is reviewed by Klauer and Musch (2003) is the affective-matching mechanism. In this account, it is assumed that both prime and target are activated and evaluated automatically. When prime and target are affectively congruent, a feeling of plausibility will arise, and thereby leads to a faster response for affectively congruent prime-target pairs. When prime and target are affectively incongruent, a feeling of implausibility will arise, and thereby leads to a slower response for affectively incongruent prime-target pairs. This mechanism does not require that the evaluation task be used, but only that affirmative or non-affirmative responses have to be made. However, this mechanism cannot explain findings in the naming task either.

In sum, the debate about theoretical underpinnings of different indirect measures has not been resolved. Importantly, the theoretical accounts that are proposed for the affective priming paradigm all rely upon associative mechanisms, whereas this is not the case for the proposed theoretical mechanisms for the IAT. This suggests that the processes assessed in the IAT do not fully rely on affective associations, whereas this might be the case in the affective priming paradigm. To us, this seems an important consideration for future research with indirect measures in applied domains.

FUTURE RESEARCH

The research of this thesis consistently suggests that overeaters are not characterized by

a greater liking of high-fat palatable foods when this liking is assessed at a relatively automatic level. Overeaters and normal controls do not seem to differ in their relatively spontaneous associations with food. So, we should look elsewhere for differences between overeaters and normal controls. Interestingly, Nederkoorn and colleagues (Nederkoorn, Braet, Van Eijs, & Jansen, 2004; Nederkoorn, Van Eijs, & Jansen, in press) recently found evidence that obese children and restrained eaters are more impulsive than lean controls.

On the other hand, the focus of attention (palatability vs. health) was shown to play an important role in these relatively automatic associations. An explanation for explaining the difference in weight (obese vs. lean) might be that the food environment of obese people is different or that they perceive this environment differently. Alternatively, their impulsivity may make it more difficult to resist the temptation of palatable foods (Nederkoorn et al., in press, 2004). Instead of teaching obese people how to deal with our tempting environment, it might be a viable approach to try and change their (perception of the) environment. Brownell (e.g., Wadden et al., 2002) has been arguing for a while now that the 'toxic' environment is the place to look for effective interventions. This approach has been taken in for example the tobacco industry. Since a number of years, advertisements for cigarettes on television and in cinemas have been forbidden, thereby decreasing the number of smoking related cues. It might be beneficial to change our food environment in such a way that health related cues become more salient, and palatability related cues become less salient. Instead of being constantly reminded of all kinds of palatable high-fat foods, we might need to be reminded more of the health consequences of these foods. Possible changes in our environment include modifying the display of foods in supermarkets in such a way that healthy foods are featured more prominently, putting healthy foods on the menu in school cafeterias, promoting physical exercise, decreasing the number of advertisements for high-fat palatable foods, and reducing the price of low-fat foods.

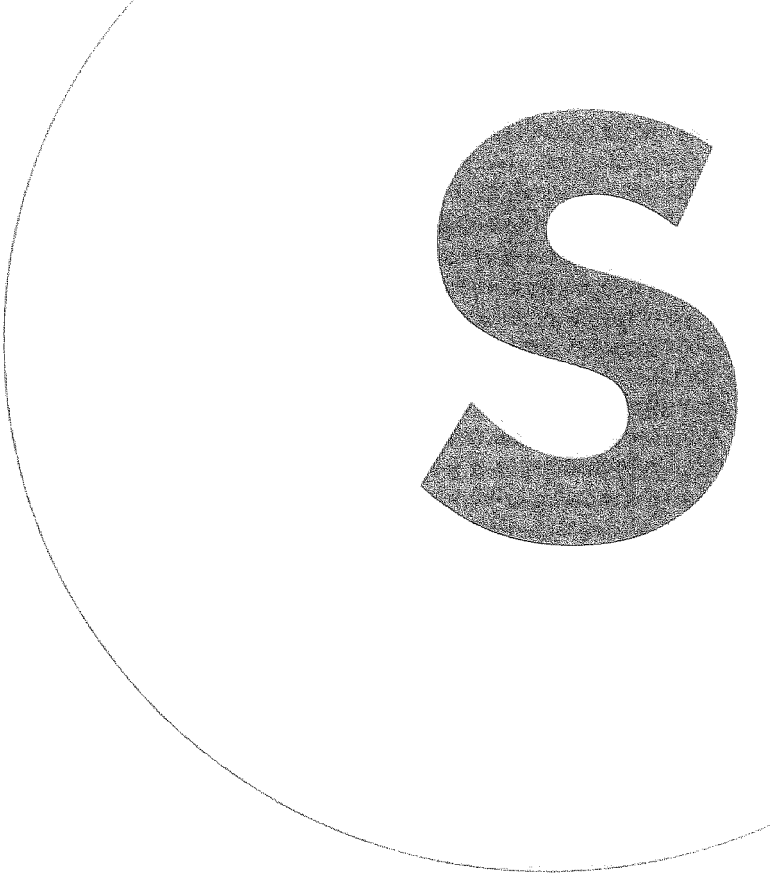
As expected, anorexia nervosa patients no longer seemed to value the palatability of food in comparison to lean controls. In future research it would be interesting to investigate whether this truly means that their responsiveness to the palatability of food has been extinguished. For example, if anorexia nervosa patients were focused on the palatability of food as were half of the participants in Experiment 1 of Chapter 7, would they still not show relatively automatic associations with food based on its palatability? Moreover, it would be interesting to study whether anorexia nervosa patients could learn to associate food with palatable or unpalatable again. A possibility to achieve this would be to condition palatable foods with positive outcomes.

On a more methodological note, in Chapter 4, the issue of general response speed was briefly discussed, in that slower responding was mentioned as a possible contributing factor to the absence of priming effects. Hermans, Smeesters, De Houwer, and Eelen (2002) also discuss this possibility, and report an interaction between the priming effect and block as a weak form of evidence that speed of responding might be an important variable for the priming effect. This line of reasoning fits well with SOA manipulation studies (Hermans, De Houwer, & Eelen, 2001), in which priming effects are only found at short SOAs, with an optimum at a SOA of 150 ms. However, to our knowledge, no systematic research has been conducted regarding the issue of speed. This might be an idea for the future. Moreover, the issue of automaticity is far from being solved as was discussed in Chapter 2. Exactly which criteria for automaticity are met by the different indirect measures? For example, the issue of awareness of what is being measured has not been systematically investigated for the supraliminal affective priming paradigm.

IN CLOSING

Overeating was not found to be related to an increased pleasure of food at an early stage of cognitive processing, whereas undereating was found to be related to a decreased pleasure of food at an early stage of cognitive processing. To explain differences in weight between overeaters and normal controls, one should look elsewhere. The research in this thesis was conducted mainly by using indirect response latency measures, which appeared to be very sensitive to the precise experimental context. The 'toxic' environment in which we live may be a more important cause of obesity than was previously thought.

SUMMARY



INTRODUCTION AND CENTRAL QUESTION

Research has shown that a liking for the sensory aspects of food is the most important factor determining food choice (Eertmans, Baeyens, & Van den Bergh, 2001). Meaningful individual differences may exist in exactly how important palatability is, and in the extent to which specific types of food are considered palatable. For obese people the palatability of a food may be more important than for lean people (Nisbett, 1968; Pliner, Herman, & Polivy, 1990; Spiegel, Shrager, & Stellar, 1989), and the obese may have a specific preference for high-fat foods (e.g., Mela & Sacchetti, 1991; Rissanen et al., 2002). Another group of people who may be at risk for overeating is formed by the restrained eaters. Restrained eaters are people who want to loose weight, but regularly fail and indulge in exactly those high-fat palatable foods that they normally consider 'forbidden' (Herman & Polivy, 1980; 2004). Restrained eating is hypothesized to be associated with (high-fat) palatable foods being extra desirable (Gendall & Joyce, 2001; Stice, 2002). A very different group of people with eating problems is formed by anorexia nervosa patients. Palatability of food may be relatively unimportant for them, because food may have lost its positive incentive value (Pinel, Assanand, & Lehman, 2000). This deficit may make food restriction easier in that food may no longer be seen as something that can be palatable or unpalatable.

The studies described in this thesis were concerned with exactly those individual differences in the evaluation of food. The central question that was addressed in this thesis was whether an increased 'pleasure of food' at an early stage of cognitive processing is related to overeating and obesity, and whether a decreased 'pleasure of food' at an early stage of cognitive processing is related to undereating, anorexia nervosa. We were interested in the associations people have with food at an early stage of cognitive processing. Because palatability is found to be the most important characteristic of food (Eertmans et al., 2001), we expected that people's early associations with food would be based on the palatability of the food.

The rationale for studying these automatic associations was that if an increased positive association with high-fat palatable food was detected for overeaters at this early stage of information processing, it would be expected that that always experience this association, and always have to suppress it to be able to successfully inhibit their food consumption. It would also suggest that an intervention aimed at controlled processing would be a rather inefficient form of therapy, and should better be directed at these early positive associations with high-fat palatable foods. If anorexia nervosa patients were shown to be less sensitive to the palatability of food at an early stage of cognitive processing, it would suggest that also for anorexia nervosa patients, therapy might better be directed at these early cognitive processes.

METHODOLOGY

We addressed our central question using so-called indirect response latency paradigms (e.g., Fazio & Olson, 2003), such as the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), the affective priming paradigm (Fazio, Sanbonmatsu, Powell, & Kardes, 1986), and the Extrinsic Affective Simon Task (EAST; De Houwer, 2003b). For an overview and specific methodology, the reader is referred to Chapter 2. In short, in each of these paradigms word stimuli are presented one at a time and response latencies are measured.

Depending on the paradigm, the instructions for the participant vary. The common idea behind these paradigms is that participants will respond faster when a certain association is easier. Applied to our research, the pattern of latencies informs us how people evaluate different kinds of foods. For example, in the affective priming paradigm, two stimuli are presented in quick succession. The first word (prime) always was a food item, and the second word (target) always was a general positive or negative word. Participants were instructed to just read the prime and to evaluate the target as quickly as possible. If a participant prefers chocolate over chicory, he or she will respond faster to the combinations 'chocolate - positive target word' and 'chicory - negative target word' than to the combinations 'chicory - positive target word' and 'chocolate - negative target word'. The valence of the prime influences the speed of evaluation of the valence of the target.

These measures can objectively be considered indirect, because the researcher does not need to ask directly what someone for example thinks of chocolate. An evaluation or attitude can be inferred from the pattern of response latencies. Depending on exactly which paradigm is used, the processes assessed in these paradigms meet some criteria of automaticity, whereas they fail to meet other criteria of automaticity. Features of automaticity include: unawareness, uncontrollability, goal independency, unintentionality, and efficiency. Exactly which criteria are met is always an empirical question.

For the IAT, it can be concluded for now that the assessed processes are rather uncontrollable, at least when participants are inexperienced and are naïve as to the purpose and mechanism of the IAT. Concerning the feature of unawareness, it seems unlikely that participants are unaware of the assessed attitude itself, whereas evidence suggests that participants may be unaware of what their attitude originated from. Monteith, Voils, and Ashburn-Nardo (2001) found that some participants were aware that their attitudes were being assessed. Note that the criteria of unintentionality or goal independence seem impossible to meet given the nature of the IAT procedure. The EAST is an even newer measure than the IAT (De Houwer, 2003b), and no specific experiments concerning the features of automaticity could be found. It could be argued that the EAST is less 'obvious' for participants, and may be unobtrusive (i.e., unaware of measurement) and uncontrollable to at least the same degree as the IAT. For supraliminal affective priming, different aspects of automaticity have been systematically studied. The findings that priming effects only exist at short SOAs and disappear at longer SOAs is indirect, but rather strong, evidence that priming effects are due to fast-acting processes (Hermans, De Houwer, & Eelen, 2001; Hermans, Spruyt, & Eelen, 2003). Moreover, evidence (Hermans, Crombez, & Eelen, 2000) suggests that the processes in this paradigm are relatively efficient. Affective priming effects with the evaluation task can only be considered unintentional in the sense that participants are not given the instruction to evaluate the primes, and that participants may not intentionally use the valence of the prime to evaluate the valence of the target. The criterion of goal-independency is not met by the affective priming paradigm with the evaluation task. For the features of uncontrollability and unawareness of the attitude-measurement, no direct evidence could be found. It could be argued that when the speeded nature of the task (i.e., short SOA and instructions emphasizing speed) is preserved, participants hardly have any time for controlled processing, so are unlikely to be able to control the effect. However, this issue remains for further research.

CONCLUSIONS

For an overview of empirical findings the reader is referred to Chapter 8. Conclusions:

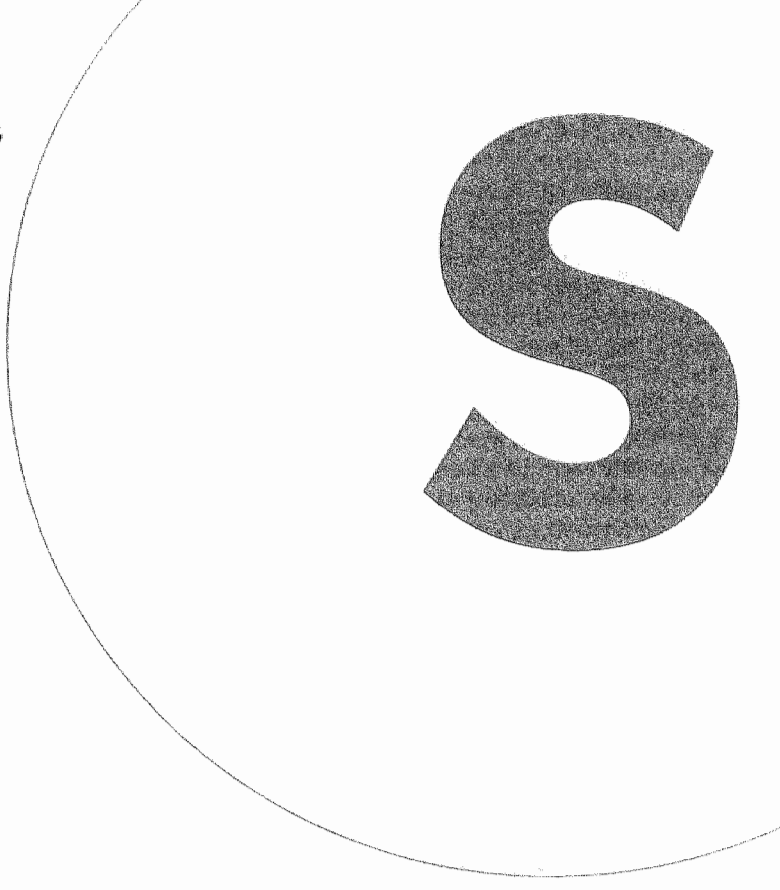
1. The first hypothesis was that overeating is related to an increased pleasure of food at an early stage of cognitive processing. In this thesis, no support for this hypothesis was found, in that no stable differences in relatively automatic evaluations of food between overeaters and normal controls were found in the expected direction (Chapter 3, 4, and 5). A difference between obese people and lean controls was found in the IAT study (Chapter 3), but was in the opposite direction. Obese people and lean controls showed more negative associations with high-fat foods than with low-fat foods, and this effect was most pronounced for the obese. This effect is likely explained by the specific characteristics of the IAT (De Houwer, 2001), in that fat content was a very salient feature in this task.

2. Though it does not represent a stable difference between obese people and lean controls, obese people's automatic evaluations of food were associated positively with the level of experienced initial craving. The greater the experienced craving, the greater the relatively automatic liking of palatable over unpalatable foods was. This correlation was in the same direction for lean controls, but missed significance.

3. Our second main hypothesis, that anorexia nervosa is related to a decreased pleasure of food at an early stage of cognitive processing, was confirmed (Chapter 5). A group of anorexia nervosa patients did not show a palatability priming effect whereas a lean control group did. This suggests that anorexia nervosa patients are no longer sensitive to the palatability of food when assesses at an early stage of cognitive processing. Note that the anorexia nervosa patients responded generally slower than the lean control group.

4. Environment plays an important role in relatively automatic associations. The IAT study (Chapter 3) unintentionally focused participants on the fat content of the foods. In this IAT study, low-fat foods were preferred over high-fat foods. The study with obese participants reported in Chapter 5 took place in a hospital - an environment in which health is salient. Participants preferred low-fat palatable foods over high-fat palatable foods in this study. Note that in a relatively neutral environment (university) and paradigm palatable foods were preferred over unpalatable foods, and this preference was not modified by the fat content of the foods (Chapter 4; control group study 1 in Chapter 5). Because palatability is considered the most important aspect of food (Eertmans et al., 2001) it may not be surprising that a relatively automatic evaluation of food is based on palatability in a neutral environment. In the studies in Chapter 7, we intentionally manipulated the salience of palatability and health factors. The relatively automatic evaluations of food were influenced by both the current focus of attention, and for obese people by the degree of initial experienced craving. In Experiment 1 (Chapter 7), if the manipulation focused on palatability aspects, a relatively automatic evaluation of the foods was based on palatability. If the manipulation focused on health aspects, a relatively automatic evaluation was based on the healthiness of the foods. This finding is important, because in our so-called 'toxic' environment (Wadden, Brownell, & Foster, 2002) we are constantly confronted with all sorts of palatable foods, and health-related cues are less abundant. This may lead to a categorization of food into palatable and unpalatable, and thereby to relatively automatic evaluations based on palatability. People may thus not be reminded of the health consequences of food often enough. The environment may play a more important role in the obesity epidemic than was thought before (e.g., Wadden et al., 2002).

SAMENVATTING



INTRODUCTIE EN CENTRALE VRAAGSTELLING

De smakelijkheid van voeding heeft een grote invloed op onze voedingskeuze (Eertmans, Baeyens, & Van den Bergh, 2001). Hoe belangrijk de smakelijkheid van eten precies is verschilt tussen mensen. Onderzoek suggereert bijvoorbeeld dat de smakelijkheid van voeding belangrijker is voor mensen met obesitas dan voor slanke mensen (Nisbett, 1968; Pliner, Herman, & Polivy, 1990; Spiegel, Shrager, & Stellar, 1989). Bovendien zijn er aanwijzingen dat obesen een sterkere voorkeur hebben voor vettere voedingsmiddelen (b.v., Mela & Sacchetti, 1991; Rissanen et al., 2002). Een andere groep mensen die het risico loopt zich te overeten wordt gevormd door de zogenaamde 'beperkte eters'. Beperkte eters zijn mensen die gewicht willen verliezen, maar daar regelmatig niet in slagen en dan precies die vette en lekkere dingen eten die ze normaal zien als 'verboden' (Herman & Polivy, 1980, 2004). Een gangbare hypothese is dat dit beperkt eetgedrag geassocieerd is met een verhoogde aantrekkelijkheid van vette lekkere voeding (Gendall & Joyce, 2001; Stice, 2002). Een geheel ander soort eetproblematiek is anorexia nevosa. Volgens Pinel, Assanand en Lehman (2000) is de smaak van voeding bij deze groep relatief onbelangrijk; voeding zou zijn positieve beloningswaarde verloren hebben. Hierdoor zou het weleens gemakkelijker kunnen zijn om voedselinname te beperken, omdat voeding niet langer gezien wordt als iets dat smakelijk of onsmakelijk is.

De studies die beschreven zijn in dit proefschrift betroffen precies deze individuele verschillen in de evaluatie van voeding. De centrale vraag van dit proefschrift was of een toegenomen 'eetgenot' in een vroeg stadium van cognitieve verwerking gerelateerd is aan overeten en obesitas, en of een afgenomen 'eetgenot' in een vroeg stadium van cognitieve verwerking gerelateerd is aan te weinig eten, anorexia nervosa. We waren geïnteresseerd in de associaties die mensen hebben met eten in een vroeg stadium van cognitieve verwerking. Aangezien de smaak van eten het belangrijkste kenmerk is van eten (Eertmans et al., 2001), verwachtten we dat deze vroege associaties met voeding gebaseerd zijn op de smakelijkheid van voeding.

De rationale voor het bestuderen van deze relatief automatische associaties was dat als er inderdaad bewijs gevonden zou worden voor versterkt positieve associaties met lekker (vet) eten bij overeters (obesen en beperkte eters), dit zou kunnen betekenen dat ze deze positieve associaties altijd ervaren en dus altijd moeten onderdrukken om hun voedselinname te beperken. Dit zou ook betekenen dat een interventie die gericht is op gecontroleerde verwerking weinig efficiënt is, en beter gericht zou kunnen worden op deze vroege positieve associaties met lekker vet eten. Als aangetoond zou worden dat anorexia nervosa-patiënten verminderd gevoelig zijn voor de smakelijkheid van eten in een vroeg stadium van cognitieve verwerking, zou dat suggereren dat ook voor anorexia nervosa-patiënten een therapie beter gericht kan worden op deze vroege cognitieve processen.

METHODOLOGIE

In ons onderzoek hebben we voornamelijk zogenaamde indirecte reactietijdmaten (b.v., Fazio & Olson, 2003) gebruikt, zoals de 'Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), het 'affective priming paradigm' (Fazio, Sanbonmatsu, Powell, & Kardes, 1986) en de 'Extrinsic Affective Simon Task' (EAST; De Houwer, 2003b). In Hoofdstuk 2

wordt een gedetailleerd overzicht gegeven van deze methodologie. Kort gezegd worden in deze drie paradigma's verschillende woordstimuli na elkaar aangeboden en worden reactietijden gemeten. Afhankelijk van het gebruikte paradigma verschilt de instructie aan proefpersonen. Het gemeenschappelijke idee achter deze paradigma's is dat mensen kortere reactietijden zullen laten zien als een bepaalde associatie gemakkelijker gelegd wordt. Toegepast op ons onderzoek, uit het patroon van reactietijden kan afgeleid worden hoe mensen voedingsmiddelen evalueren. In het 'affective priming paradigm' bijvoorbeeld, worden twee woorden snel na elkaar aangeboden. Het eerste woord ('prime') is altijd een voedingsmiddel en het tweede woord ('target') is altijd een algemeen positief of negatief woord. De 'prime' hoeft alleen gelezen te worden, en de 'target' moet snel geëvalueerd worden. Als een proefpersoon chocola lekkerder vindt dan spruitjes, zal hij of zij sneller reageren op de combinaties 'chocola - positief target woord' en 'spruitjes - negatief target woord' dan op de combinaties 'spruitjes - positief target woord' en 'chocola - negatief target woord'. De valentie van de 'prime' beïnvloedt dus de snelheid van evaluatie van de valentie van de 'target'. Een belangrijk kenmerk van deze paradigma's is dat ze indirect zijn. Indirect betekent hier dat een onderzoeker niet rechtstreeks aan een proefpersoon vraagt wat hij of zij bijvoorbeeld van chocola vindt. In plaats daarvan wordt de evaluatie van bijvoorbeeld chocola afgeleid uit het patroon van de reactietijden. Indirecte reactietijdmaten voldoen aan bepaalde criteria van automaticiteit, terwijl ze juist niet aan andere criteria van automaticiteit voldoen. De kenmerken van automaticiteit zijn: onbewust, oncontroleerbaar, doel-onafhankelijk, niet-intentioneel en efficiënt. Aan welke criteria precies wordt voldaan is afhankelijk van het gebruikte paradigma en altijd een empirische vraag.

Voor de IAT kan voorlopig geconcludeerd worden dat de processen die gemeten worden in bepaalde mate oncontroleerbaar zijn, als de proefpersonen tenminste geen eerdere ervaring met de IAT hebben en het doel en mechanisme van de IAT niet kennen. Het lijkt onwaarschijnlijk dat proefpersonen zich niet bewust zijn van de attitude of evaluatie die gemeten wordt. Bovendien toonden Monteith, Voils, en Ashburn-Nardo (2001) aan dat een aanzienlijk deel van hun proefpersonen zich bewust was van de meting van hun attitude. Door de aard van het paradigma kan de IAT niet voldoen aan de criteria 'doel-onafhankelijk' en 'niet-intentioneel'. Naar het criterium 'efficiëntie' is voor de IAT nog geen onderzoek gedaan. Voor de EAST is nog helemaal geen specifiek onderzoek gedaan naar de criteria van automaticiteit, aangezien dit nog een heel nieuw paradigma is (2003). Men zou kunnen betogen dat EAST-effecten minsten zo oncontroleerbaar zijn als IAT effecten en dat proefpersonen zich in gelijke of mindere mate bewust zijn van de meting, omdat de EAST wat ingewikkelder is en het dus minder duidelijk is wat er gemeten wordt. Voor supraliminale 'priming' zijn verschillende aspecten van automaticiteit systematisch onderzocht. De bevinding dat 'priming' effecten alleen gevonden kunnen worden bij korte SOAs en verdwijnen bij langere SOAs, is indirect maar sterk bewijs dat 'priming' effecten veroorzaakt worden door snelle processen (Hermans, De Houwer, & Eelen, 2001; Hermans, Spruyt, & Eelen, 2003). Bovendien suggereert onderzoek van Hermans, Crombez, en Eelen (2000) dat de processen in dit paradigma relatief efficiënt zijn. Aan het criterium 'niet-intentioneel' wordt maar in bepaalde mate voldaan. 'Affective priming' effecten met de evaluatie-taak kunnen alleen als niet-intentioneel beschouwd worden in de zin dat proefpersonen niet de instructie krijgen om de 'primes' te evalueren, en dat proefpersonen misschien niet de evaluatie van de 'primes' intentioneel gebruiken om de 'targets' te evalueren. Aan het criterium 'doel-onafhankelijk' wordt niet voldaan door het 'affective priming paradigm' met de

evaluatie-taak. Ten slotte, voor de kenmerken 'oncontroleerbaar' en 'onbewust' zijn nog geen specifieke studies gedaan. Men zou kunnen betogen dat als het snelle karakter van de taak behouden wordt en wanneer proefpersonen zeer weinig tijd krijgen voor gecontroleerde verwerking, het 'affective priming' effect waarschijnlijk niet controleerbaar is.

OVERZICHT EMPIRISCHE BEVINDINGEN

In ons eerste experiment (Hoofdstuk 3) gebruikten we de IAT (Greenwald et al., 1998) om de hypothese te testen dat obesen een sterkere relatief automatische voorkeur voor vette voeding zouden vertonen dan slanke controles. De resultaten suggereren exact het tegenovergestelde: alle proefpersonen lieten een voorkeur zien voor magere voeding boven vette voeding op relatief automatisch niveau. Bovendien was dit effect het sterkst voor de obesen. Betekenen deze resultaten nu dat onze theorie niet klopt? Zou het kunnen dat obesen simpelweg niet gekenmerkt worden door een specifieke voorkeur voor vette lekkere voeding? In Hoofdstuk 3 suggereren we dat deze conclusie waarschijnlijk nog wat prematuur is en wordt een alternatieve verklaring geboden. De bevindingen werden verklaard in termen van De Houwers (2001) structuur en proces analyse van de IAT. De Houwer (2001) toonde aan dat IAT effecten voornamelijk bepaald worden door de categorie labels (zie ook Mitchell, Nosek, & Banaji, 2003). Dus in plaats van associaties met individuele voedingsmiddelen (b.v., chocola), maten we associaties met de categorieën 'vet' en 'mager'. Het is waarschijnlijk geen verrassing dat (vooral obese) mensen negatieve associaties hebben met de hoge vetinhoud van sommige voedingsmiddelen, terwijl ze de smaak van bijvoorbeeld chocola wel aangenaam vinden.

Om dit probleem met categorieën (vet vs. mager) te voorkomen, testten we onze hypothese voor overeters in twee andere paradigma's, namelijk in het 'affective priming paradigm' (Fazio et al., 1986) en in de EAST (De Houwer, 2003b). In Hoofdstuk 4 worden twee experimenten beschreven waarin beperkte eters vergeleken worden met onbeperkte eters. In beide experimenten, een met het 'affective priming paradigm' en een met de EAST, werd gevonden dat mensen op relatief automatisch niveau een voorkeur laten zien voor smakelijke voeding boven onsmakelijke voeding. De resultaten werden niet beïnvloed door de 'lijn-status (beperkt vs. niet beperkt) van proefpersonen of de vetinhoud van de voedingsmiddelen. Dus alle proefpersonen reageerden simpelweg op basis van de smakelijkheid van de voedingsmiddelen. Het zou verleidelijk zijn om nu te concluderen dat beperkte en niet-beperkte eters niet verschillen in hun 'responsiviteit' op eten. Maar, hoewel beperkte en niet-beperkte eters misschien niet verschillen in hun evaluatie ('liking') van voeding, zouden ze kunnen verschillen in hun 'craving' (ofwel 'wanting') voor deze voedingsmiddelen (zie Berridge, 1996).

Om de hypothese te testen dat obesen een sterkere voorkeur zouden hebben voor vette lekkere voedingsmiddelen, testten we een groep obesen en een groep slanke controles in het 'affective priming paradigm' (Hoofdstuk 5, Experiment 2). De resultaten van dit experiment suggereren dat de vetinhoud van de voedingsmiddelen negatief geëvalueerd wordt. Alle proefpersonen lieten een voorkeur zien voor magere lekkere voedingsmiddelen boven vette lekkere voedingsmiddelen. Dit suggereert dat gezondheids- of gewichtsoverwegingen de reacties beïnvloedden. Deze resultaten waren enigszins verrassend omdat het 'affective priming paradigm' als neutraal gezien zou kunnen worden, omdat proefpersonen de 'primes' (voedingsmiddelen) niet in vantevoren vastgestelde categorieën (vergelijk IAT:

vet vs. mager) hoefden te sorteren. Deze resultaten zijn dus weer in tegenstelling met onze hypothese dat overeters een sterkere voorkeur zouden hebben voor vette lekkere voeding dan normale controles. Een mogelijke verklaring voor het verschil in resultaten tussen dit experiment en de experimenten die in Hoofdstuk 4 werden gerapporteerd zou de context waarin de experimenten plaatsvonden kunnen zijn. Het tweede experiment van Hoofdstuk 5 vond namelijk plaats in een ziekenhuisomgeving, een omgeving waarin gezondheid natuurlijk saillant is. Zoals Blair (2002) beschrijft, kunnen subtiele context-manipulaties een sterke invloed hebben op de processen die gemeten worden met indirecte reactietijdmaten. Deze mogelijkheid werd onderzocht in Hoofdstuk 7. Daarnaast was de groep obesen trager met reageren, wat voor een teveel aan gecontroleerde verwerking kan hebben gezorgd, en daardoor tot een afwezigheid van een smaak 'priming' effect.

In het eerste experiment van Hoofdstuk 5 vergeleken we een groep anorexia nervosa (AN) patiënten met een groep normale controles (slanke niet-beperkte eters) in het 'affective priming paradigm'. We testten de hypothese dat AN-patiënten een verminderde gevoeligheid voor de smakelijkheid van eten zouden laten zien op een relatief automatisch niveau. De resultaten van dit experiment bevestigde de hypothese: de controlegroep liet wel een smaak 'priming' effect zien (vergelijkbaar met effect in Hoofdstuk 4), terwijl de AN-groep dit niet deed. Deze resultaten laten zien dat AN-patiënten voedingsmiddelen niet automatisch categoriseren als smakelijk of onsmakelijk. Het zou dus kunnen dat de smakelijkheid van voeding niet zo belangrijk meer is voor AN-patiënten. Dit zou beperking van voedselinname gemakkelijker kunnen maken. De interpretatie van resultaten wordt echter enigszins bemoeilijkt omdat de AN-groep significant langzamer was dan de controlegroep. De AN-groep zou dus teveel tijd gehad kunnen hebben voor meer gecontroleerde verwerking, waardoor het 'priming' effect niet optrad. Het is onduidelijk waarom de AN-groep zo langzaam reageerde. Deze vertraging zou kunnen reflecteren dat eten een bron van zorgen is voor hen en daardoor hun aandacht langer vasthoudt (vergelijk: emotioneel Stroop-effect; Williams, Mathews, & MacLeod, 1996). Daarnaast zouden AN-patiënten cognitief langzamer kunnen zijn (Green, Elliman, Wakeling, & Rogers, 1996).

De traagheid van reageren in zowel de groep obesen als de AN-groep (Hoofdstuk 5) suggereert dat er meer tijd was voor gecontroleerde verwerking. In Hoofdstuk 6 onderzochten we de effecten van meer gecontroleerde verwerking van voedingsinformatie op voedingsconsumptie in een zogenaamde smaaktest. We vergeleken een groep obesen met een groep slanke controles. Obesen vinden vette voedingsmiddelen misschien lekkerder, maar ze scoren ook vaak hoger op vragenlijsten over zorgen om eten, uiterlijk en gewicht. Zo ook in het experiment van Hoofdstuk 6. In dit experiment kregen proefpersonen 'nep-informatie' over de vetinhoud van twee zuiveldranken die proefpersonen moesten proeven in een zogenaamde smaaktest. De zuiveldranken werden als vet of als mager gelabeld. De hypothese was dat proefpersonen minder zouden drinken van de zuiveldrank die als vet gelabeld werd dan de drank die als mager gelabeld werd, en dat dit effect sterker zou zijn voor obesen dan voor controles. Het label-effect was in de verwachte richting van minder consumptie van de als vet gelabelde drank dan van de als mager gelabelde drank, maar was niet significant. Dit effect was wel significant voor de geschatte toekomstige consumptie. Onverwacht had de volgorde (eerste smaaktest label vet vs. eerste smaaktest label mager) een grote invloed op consumptie, wat de interpretatie van de resultaten bemoeilijkt. De factor groep (obees vs. controle) had geen invloed op de resultaten.

Zoals al even werd opgemerkt (zie Hoofdstuk 2 en 5), spelen context en focus van aandacht waarschijnlijk een belangrijke rol bij relatief automatische associaties (zie Blair,

2002). In de westerse wereld is er een overvloed aan lekkere vette voedingsmiddelen. Op bijna elke straathoek word je herinnerd aan een bepaald lekker voedingsmiddel. De omgeving zou kunnen beïnvloeden hoe een voedingsmiddel wordt voorgesteld (zie Mitchell et al., 2003; Smith, Fazio, & Cejka, 1996). Chocola kan bijvoorbeeld gezien worden als een lekker voedingsmiddel of als een heel ongezond vet voedingsmiddel. Het doel van de experimenten van Hoofdstuk 7 was te onderzoeken hoe de context relatief automatische associaties met voeding beïnvloedt.

In het eerste experiment van Hoofdstuk 7 manipuleerden we de focus van aandacht door proefpersonen eerst een script te laten lezen en daarna een aantal vragen daarover te stellen. De helft van de proefpersonen werd gevraagd zich een voorstelling te maken van een restaurant-eigenaar die een feestmaal moet bereiden en zich in die rol in te leven. De andere helft van de proefpersonen kreeg informatie over gezonde voeding. Deze manipulaties beïnvloedden het 'priming' effect in de verwachte richting. In de 'restaurant-conditie' was het 'priming' effect gebaseerd op smakelijkheid van voeding, terwijl het gebaseerd was op gezondheids- of gewichtsoverwegingen in de 'gezonde voeding conditie'. Gewichtstatus (obees vs. slank) had geen invloed op het 'priming' effect.

In het tweede experiment van Hoofdstuk 7 probeerden we proefpersonen hun aandacht te laten vestigen op de smaak van voeding door een 'craving' inductie. In een 'craving' inductie wordt een sterke drang naar lekker eten opgewekt, door proefpersonen aan hun favoriete voedingsmiddelen bloot te stellen zonder dat ze ervan mogen eten. Ze moeten er wel intensief aan ruiken. Voor obesen was er een significante positieve correlatie tussen het niveau van initieel ervaren 'craving' en de grootte van het smaak 'priming' effect (i.e., een grotere voorkeur voor smakelijke voeding boven onsmakelijke voeding op relatief automatisch niveau bij hogere levels van initiële 'craving'). Deze correlatie was ook voor de controlegroep positief, maar was niet significant. Onverwacht was het 'priming' effect voor de groep als geheel positiever voor magere voedingsmiddelen dan voor vette voedingsmiddelen. Een mogelijke verklaring voor deze bevinding is dat het experiment wederom in een ziekenhuisomgeving plaatsvond.

Samenvattend suggereren de experimenten van Hoofdstuk 7 dat onze 'giftige omgeving' (Wadden, Brownell, & Foster, 2002) - een omgeving met veel lekker vet eten - een belangrijke rol speelt bij onze relatief automatische evaluaties van voeding. 'Cues' die herinneren aan de smakelijkheid van voeding zijn overal om ons heen. Dit zou ertoe kunnen leiden dat relatief automatische associaties met voedingsmiddelen vooral gebaseerd worden op de smakelijkheid van voeding, en minder op de gezondheid van deze voedingsmiddelen.

CONCLUSIES

Onze belangrijkste conclusies kunnen als volgt worden samengevat:

1. De eerste hypothese was dat overeten gerelateerd is aan een toegenomen 'eetgenot' in een vroeg stadium van cognitieve verwerking. In dit proefschrift werd geen bewijs gevonden voor deze hypothese. Er werden geen stabiele verschillen in de verwachte richting gevonden in relatief automatische associaties met voeding tussen overeters en normale controles (Hoofdstuk 3, 4 en 5). In de IAT-studie (Hoofdstuk 3) werd wel een verschil gevonden tussen mensen met obesitas en normale controles, maar dit verschil was in de tegenovergestelde richting. Obesen en controles lieten een negatievere associatie met

vette voeding zien dan met magere voeding en dit effect was bovendien sterker voor de obesen. Dit effect kan waarschijnlijk verklaard worden door de specifieke kenmerken van de IAT (De Houwer, 2001). In dit paradigma was de vetinhoud van de voedingsstimuli een erg opvallend kenmerk. Proefpersonen moesten voedingsmiddelen namelijk categoriseren op basis van vetinhoud. Mensen kunnen bijvoorbeeld wel van chocola houden, maar niet van het feit dat chocola vet is.

2. Hoewel het geen stabiel verschil is tussen obesen en controles, waren de automatische evaluaties van voeding voor obesen positief geassocieerd met het niveau van de initieel ervaren 'craving'. Hoe groter de ervaren 'craving', des te groter was de relatieve voorkeur voor smakelijke voeding boven onsmakelijke voeding. Deze correlatie was voor de controles in dezelfde richting, maar was niet significant.

3. Onze tweede hypothese, dat anorexia nervosa (AN) gerelateerd is aan een afgenomen 'eetgenot' in een vroeg stadium van cognitieve verwerking, kon worden bevestigd (Hoofdstuk 5). Een groep AN-patiënten liet geen smaak 'priming' effect zien, terwijl een slanke controlegroep dat wel deed. Dit suggereert dat AN-patiënten niet zo gevoelig meer zijn voor de smakelijkheid van voeding wanneer deze gemeten wordt in een vroeg stadium van cognitieve verwerking. De bevinding dat de AN-groep trager was dan de controlegroep bemoeilijkt de interpretatie van de resultaten.

4. De omgeving speelt een belangrijke rol bij relatief automatische associaties. De IAT studie (Hoofdstuk 3) richtte de aandacht van de proefpersonen onbedoeld op de vetinhoud van voeding. In deze IAT studie werden magere voedingsmiddelen verkozen boven vette voedingsmiddelen. De studie met obesen gerapporteerd in Hoofdstuk 5 vond plaats in een ziekenhuis - een omgeving waarin gezondheid natuurlijk saillant is. Proefpersonen lieten een voorkeur zien voor lekkere magere voeding boven lekkere vette voeding. Opvallend was dat in een relatief neutrale omgeving (universiteit) en paradigma ('affective priming paradigm') wel een voorkeur voor smakelijke boven onsmakelijke voeding werd gevonden, onafhankelijk van de vetinhoud van voedingsmiddelen (Hoofdstuk 4; controlegroep Experiment 1 van Hoofdstuk 5). Aangezien smakelijkheid van voeding de belangrijkste factor voor voedingskeuze is (Eertmans et al., 2001), is het misschien niet verrassend dat een relatief automatische evaluatie van voeding op smakelijkheid gebaseerd wordt in een neutrale omgeving.

In de studies van Hoofdstuk 7 werd de opvallendheid van smaak- en gezondheidsfactoren gemanipuleerd. De relatief automatische associaties met voeding werden beïnvloed door de huidige focus van aandacht, en voor obesen door de mate van initieel ervaren 'craving'. In het eerste experiment van Hoofdstuk 7 was het 'priming' effect gebaseerd op smakelijkheid van voeding als de voorafgaande manipulatie gericht was op smaak, en was het gebaseerd op gezondheidsaspecten als de voorafgaande manipulatie gericht was op de gezondheid van voeding. Deze bevinding is belangrijk omdat we in onze zogenaamde 'giftige omgeving' (Wadden et al., 2002) continue herinnerd worden aan de heerlijkheid van lekkere vette voeding, terwijl gezondheid gerelateerde cues minder vaak voorkomen. Dit zou ertoe kunnen leiden dat onze relatief automatische evaluaties van voeding vooral op de smakelijkheid van voeding gebaseerd worden en minder op gezondheidsaspecten. De omgeving zou dus wel eens een belangrijke rol in de huidige obesitas epidemie kunnen spelen (zie Wadden et al., 2002).

R

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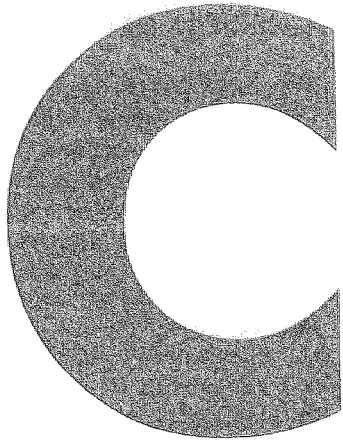

CURRICULUM VITAE

Anne Roefs was born on April 30, 1976, in Liempde, the Netherlands. In July 1994 she graduated from secondary school (Atheneum, Jacob Roeland Lyceum in Boxtel). After that, she studied hotel management for two years (propedeuse in 1995). In 1996 she started studying psychology at Maastricht University. She conducted the research for her master's thesis at the University of Toronto in Canada. In June 2000 she graduated cum laude, and received her master's degree in cognitive psychology. In July 2000 she began her PhD project at the Faculty of Psychology at Maastricht University. Part of the research for this project was conducted at the University of Toronto. Since October 2004 she is a postdoctoral fellow at the Faculty of Psychology in Maastricht.

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